DOCKETED	
Docket Number:	19-SB-100
Project Title:	SB 100 Joint Agency Report: Charting a path to a 100% Clean Energy Future
TN #:	229641
Document Title:	Calif. for Green Nuclear Power, Inc. Comment Embatted Calif. Utility Spent Most for 2018 Lobbying File with the CPUC 4-2-19
Description:	CPUC Intervenor Californians for Green Nuclear Power, Inc. (CGNP) submits this CPUC filing in R.16-02-007 as one of eight exhibits supporting the continued safe operation of Diablo Canyon Power Plant (DCPP) beyond 2025 as an essential component of California's Path to a 100% Clean Energy Future. Diablo Canyon's pair of safe, reliable, cost-effective, and zero-emissions power reactors are California's largest generation plant by far, producing about 9% of California's in-state generation - the equivalent of more than 5 (five) Hoover Dams annually. In 2010, the California Energy Commission (CEC) commissioned the California Science and Technology Commission (CSTC) to prepare a pair of reports regarding the path to a 100% Clean Energy Future. The CSTC's report conclusions were clear. The safe and cost-effective solution was a dramatic expansion beyond the four commercial nuclear power reactors then in operation. The eminent CSTC scientists and engineers concluded California would require about 30 such reactors
Filer:	Gene Nelson, Ph.D.
Organization:	Californians for Green Nuclear Power, Inc.
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Chicago Tribune

Embattled California utility spent most for 2018 lobbying

KATHLEEN RONAYNE Associated Press

February 4, 2019 11:00 AM Sacramento, CA

http://www.chicagotribune.com/business/sns-bc-us--california-utility-lobbying-20190201-story.html

(This AP article appeared in the print edition of the *San Luis Obispo, California Tribune* on page 1B of the Saturday, February 2, 2019 edition with the headline "Embattled PG&E spent most on lobbying in California last year.")

Pacific Gas & Electric Corp. spent nearly $10 million on California lobbying efforts in the year before the utility giant declared bankruptcy, spending more than any other entity seeking to influence California government in 2018.

The majority of that money — more than $5 million — was spent for lobbying on proposals involving wildfire safety and response, including whether to reduce the strict liability utilities face when their equipment sparks wildfires.

Lawmakers ultimately didn't reduce the liability but passed a law making it easier for utilities to take out bonds to cover wildfire damages and pass some costs on to ratepayers.

"The actions we take are really on behalf of our customers and employees," PG&E spokeswoman Lynsey Paulo said about the spending on lobbying. The money comes from shareholders, not ratepayers, she said.

PG&E, the nation's largest utility, filed Chapter 11 bankruptcy Tuesday as it faces potentially tens of billions of dollars in liability from devastating wildfires that ripped through Northern California in 2017 and 2018. The bankruptcy filing could lead to smaller payouts to wildfire victims and increased costs for PG&E customers.

Paulo said worsening wildfires are the biggest issue facing PG&E and one of the most critical in California.

Katie Phillips, a spokeswoman for California Common Cause, a nonprofit that advocates against money in politics, said the amount the utility spent is "shocking."

"It's a demonstration that people are just trying to buy influence in Sacramento," she said. "It's really disheartening to see that they were throwing money around when people's homes and lives were at stake."

The utility disclosed its most recent lobbying numbers in a Thursday filing with the California secretary of state.

Of the nearly $10 million spent, about $9.6 million went toward general lobbying, which includes things such as hiring in-house lobbyists or major Sacramento firms to advocate on behalf of legislation as well as paying for meals or other perks for state lawmakers.

Between July and September the company spent $6 million lobbying, including buying meals and event tickets for a handful of public employees and giving more than $10,000 in campaign contributions to nine sitting lawmakers and one candidate.

The utility also spent about $350,000 lobbying the California Public Utilities Commission , the entity that regulates it and other utilities.

PG&E is facing 750 lawsuits, its lawyer said in a Thursday court hearing.

Investigators still haven't determined the cause of the massive November fire that killed at least 86 people while devastating the town of Paradise. However, PG&E reported problems with their equipment near the site where the fire started.

Among California's other major utilities, Sempra, which owns San Diego Gas & Electric, spent about $1.4 million lobbying lawmakers in 2018 and another $167,000 lobbying the public utilities commission.

Edison International, the parent company of Southern California Edison, spent just more than $4 million on general lobbying and another $191,000 to influence the CPUC.

Behind PG&E, the second-highest spender for the year was the powerful Western States Petroleum Association, which spent nearly $7.9 million to influence California government.

Among its priorities were lobbying the California Air Resources Board as it implements two pieces of cap-and-trade legislation passed last year that aim to limit greenhouse gas emissions from oil refineries and other polluters.

It also lobbied to influence regulations on low carbon fuel standards and injection wells, according to its disclosure form filed Thursday. Chevron and its subsidiaries spent about $4 million on lobbying.

California

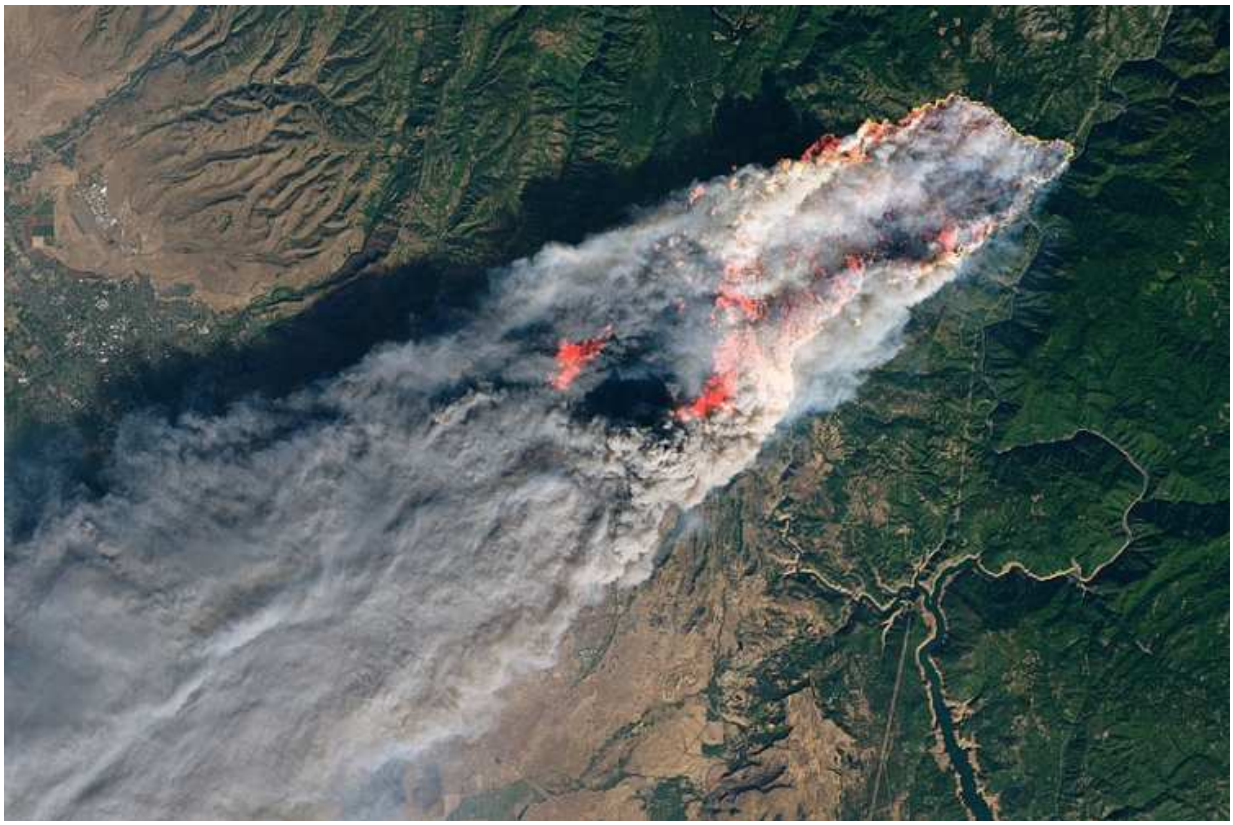
PG&E Topples Western States Petroleum Association in California Lobbying Spending in 2018

by Dan Bacher

Tuesday Feb 5th, 2019 10:03 PM

https://www.indybay.org/newsitems/2019/02/05/18820999.php

Two days before the filing of lobbying expenses by PG&E, Consumer Watchdog called for the ouster of the California Public Utilities Commission over its decision to extend a $6 billion credit line to Pacific Gas & Electric in what the group called “an unneeded emergency process that allowed no time for scrutiny.”



original image (800x533)

The Pacific Gas & Electric Company (PG&E) spent almost $10 million on lobbying California officials in 2018, surpassing even the Western States Petroleum Association in lobbying spending.

Of the total money spent last year, the company dumped $9,580,357 into general lobbying, including total payments to in-house staff lobbyists and lobbying firms, along with paying for meals and other items for legislators.

PG&E also spent $349,522 on lobbying the California Public Utilities Commission (CPUC), the regulatory agency that regulates privately owned public utilities in the state, including electric power, telecommunications, natural gas and

water companies.

The company spent the most money in the seventh quarter of the 2017-2018 session, dumping $6,111,332 into general lobbying and $168,668 into lobbying the CPUC. This is one of the largest amounts of money spent on lobbying by any organization in one quarter.

The utility filed its most recent lobbying expenses with the California Secretary of state on January 31, the final day for filing its disclosures.

Here is the total spent lobbying in 2018 by PG&E:

SESSION QUARTER	GENERAL LOBBYING	P.U.C. LOBBYING
2017-2018 8th	$1,229,703.61	$70,918.42
2017-2018 7th	$6,111,332.71	$168,668.41
2017-2018 6th	$1,655,270.60	$65,114.34
2017-2018 5th	$584,052.29	$44,822.33

Of this total money, the company spent $6,369,631 in 2018 on “payments for grassroots and other advocacy” related to state legislative proposals improving wildlife preparedness and response, according to the filing.

During a court hearing on January 31, a PG&E lawyer said the company is facing 750 lawsuits, many of them over the Camp and other fires that devastated the state over the past couple of years.

The nation's largest utility, the Pacific Gas and Electric Company filed for reorganization in federal bankruptcy court under Chapter 11 on January 29— **one day after the CPUC voted to extend a $6 billion credit line to the corporation that consumer advocates say made it easier for for PG&E to file bankruptcy.**

Two days before the filing by PG&E, Consumer Watchdog called for the ouster of the California Public Utilities Commission over its decision to extend the credit line to Pacific Gas & Electric in what the group called “an unneeded emergency process that allowed no time for scrutiny.”

“The unprecedented vote makes it easier for PG&E to go into bankruptcy and avoid accountability to wildfire victims, ratepayers and taxpayers,” according to the group.

Consumer Watchdog President Jamie Court said financing was not approved in PG&E’s first bankruptcy in 2001 “and the lights stayed on.” The nonprofit group said the decision will saddle nearly half the state's ratepayers with steep rate hikes and/or long-term debt.

“The Public Utilities Commission just gave a convicted felon six-times over a $6 billion credit line backed by ratepayers going into bankruptcy without any strings or even a credit review,” said Court. “Governor Newsom should

seek the resignation of President Picker and the members of the PUC who betrayed ratepayers and wildfire victims, as well as public officials seeking to stop PG&E from going into bankruptcy and sticking the public with billions in costs that should be shareholder obligations."

The second-highest spender for the year was the Western States Petroleum Association (WSPA) — the organization that has topped lobbying spending in California most years.

WSPA spent $7,874,807 to influence California government officials in 2018. The powerful association spent all of its money in the 2017-2018 session on general lobbying, with nothing spent on the CPUC. Of the four quarters, WSPA spent its most money lobbying, $2,649,018, in the eighth quarter, from October 1 to December 31, 2018.

The Western States Petroleum is led by President Catherine Reheis-Boyd, the former chair of the controversial Marine Life Protection Act (MLPA) initiative Blue Ribbon Task Force to create so-called "marine protected areas" in Southern California.

The total lobbying figures for WSPA in 2018 are below: cal-access.sos.ca.gov/...

SESSION QUARTER	GENERAL LOBBYING	P.U.C. LOBBYING
2017-2018 8th	$2,649,018.34	$0.00
2017-2018 7th	$1,514,828.95	$0.00
2017-2018 6th	$1,686,014.82	$0.00
2017-2018 5th	$2,024,947.91	$0.00

WSPA represents a who's who of oil companies, including oil giants BP, Chevron, ConocoPhillips, Exxon, Shell, Valero and many others. The companies that WSPA represents account for the bulk of petroleum exploration, production, refining, transportation and marketing in Arizona, California, Nevada, Oregon, and Washington, according to the WSPA website, http://www.wspa.org.

Chevron and its subsidiaries took third place in the "lobbying competition" in 2018, spending around $4 million on lobbying.

Over the past decade, WSPA and Big Oil have topped the list of spenders on lobbying the Legislature in California. During the 2015-2016 Legislative Session, the oil industry spent a historic $36.1 million to lobby lawmakers and officials in California.

WSPA was the top overall oil industry spender during the 2015-16 session, spending $18.7 million. Chevron, the second overall oil industry spender, spent $7 million in the 2015-16 session.

In 2017, Big Oil also dominated three out of the four top spots of expenditures by all lobbying organizations. Chevron placed first with $8.2 million and the Western States

Petroleum Association (WSPA) placed second with $6.2 million. The Tesoro Refining and Marketing Company finished fourth with $3.2 million.

That's a total of $17.6 million dumped into lobbying by the three top oil industry lobbying organizations alone. That figure exceeds the $14,577,314 expended by all 16 oil lobby organizations in 2016.

In the first six months of 2017, the oil industry spent more on lobbying in California, $16,360,618, than was spent by the industry in all of 2016, $16.0 million.

WSPA and Big Oil wield their power in 6 major ways: through (1) lobbying; (2) campaign spending; (3) serving on and putting shills on regulatory panels; (4) creating Astroturf groups: (5) working in collaboration with media; and (6) contributing to non profit organizations.

Because of this money and the power that Big Oil wields in California, the Jerry Brown administration, in stark contrast with its "green" facade, issued over 21,000 new oil and gas drilling permits in California. That include more than 200 permits for offshore wells in state waters -- wells within 3 miles of the California coast.

In addition, the state of California under Brown — and now under Gavin Newson - controls four times as many offshore oil wells in state waters as Trump's federal government controls in California. You can view the map showing the location of wells here: http://brownvtrumpoilmap.org.

This money and power also allowed the oil industry to write the cap-and-trade bill, AB 398, that Governor Brown signed in September 2017, as well as to twice defeat a bill to protect a South Coast marine protected area from offshore drilling.

Ironically, the same WSPA president who led the charge to defeat a bill to protect the Vandenberg State Marine Reserve from offshore oil drilling CHAIRED the Marine Life Protection Act (MLPA) Initiative Blue Ribbon Task Force to create "marine protected areas" on the South Coast. This is a classic case of the conflicts of interest that appear to define environmental politics in California, the nation's so-called "green leader."

For more information about WSPA and Big Oil, go to: http://www.dailykos.com/...

Photo: On the morning of November 8, 2018, the Camp Fire erupted 90 miles north of Sacramento, California. Photo by NASA (Joshua Stevens) - NASA Landsat 8 Operational Land Imager.

Exhibit O
https://influencemap.org/report/How-Big-Oil-Continues-to-Oppose-the-Paris-Agreement-38212275958aa21196dae3b76220bddc Archived 03 26 19 by Gene A. Nelson, Ph.D.
12 instances of "California." 3 instances of "Western States Petroleum Association."

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The Dirty Secret Of "Renewables" Advocates Is That They Protect Fossil Fuel Interests, Not The Climate

Michael Shellenberger
Contributor
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Energy I write about energy and the environment

Are climate activists aware that their renewable energy advocacy is a far more valuable form of greenwashing than any amount of oil and gas industry advertising?
AP

Everybody from Greenpeace to student activist Greta Thunberg to Green New Dealer Alexandria Ocasio-Cortez (AOC) says we have to transition from fossil fuels to renewables in order to save the climate.

But if solar and wind are substitutes for fossil fuels, why are the world's biggest oil and gas firms promoting them?

Over the last three years, the five largest publicly-traded oil and gas companies, ExxonMobil, Royal Dutch Shell, Chevron, BP, and Total invested a whopping one billion dollars into advertising and lobbying for renewables and other climate-related ventures.

Their ad blitz has targeted the global elite in airports and on Twitter. "Natural gas is the perfect partner for renewables," say airport ads run by Norwegian oil and gas giant Statoil. "See why #natgas is a natural partner for renewable power sources," tweets Shell.

Oil & gas companies promote renewables because they know solar & wind lock-in their product.
Total

No sooner had I landed in Germany, for 2017 U.N. climate talks, when I was confronted by airport ads paid for by Total, the French oil and gas company reading, "Committed to Solar" and "Committed to Natural Gas."

All of which raises the question: why, if renewable energy advocates are defenders of the climate, are they working with the oil and gas industry to replace zero-pollution nuclear plants with fossil fuels?

Why Environmentalists Turned Against Clean Energy

In the 1950s and 1960s, conservationists were pro-nuclear. They understood that nuclear plants would produce pollution-free electricity on a tiny fraction of the land required for coal mining, hydro-electric dams, and oil and gas drilling.

At the time, California's utilities were heavily regulated and had an obligation to the public to keep electricity prices low. They proposed to build nuclear plants to eliminate the state's reliance on oil and natural gas.

In the mid-1960s, the Sierra Club supported the building of the Diablo Canyon nuclear plant to replace fossil fuels. "Nuclear power is one of the chief long-term hopes for conservation," argued Sierra Club President Will Siri in 1966.

"Cheap energy in unlimited quantities is one of the chief factors allowing a large, rapidly growing population to set aside wildlands, open space and lands of high-scenic value," added Siri, who was a biophysicist, mountaineer, and veteran of the Manhattan Project.

Not everyone thought cheap energy was a good thing. "If a doubling of the state's population in the next 20 years is encouraged by providing the power resources for this growth," countered Club Executive Director, David Brower, California's "scenic character will be destroyed."

After weighing the arguments, the Sierra Club's Board of Directors voted nine-to-one to support the building of Diablo Canyon.

In response, Brower quit and started a new group, Friends of the Earth (FOE). "There's no more important issue in my life," said Brower, than to "see that Friends of the Earth does everything it can, here and abroad, to stop the nuclear experiment."

Would you be shocked to learn that the founding donor of FOE was oilman Robert Anderson, owner of Atlantic Richfield? He gave FOE the equivalent of $500,000 in 2019 dollars.

"What was David Brower doing accepting money from an oilman?" his biographer wondered. **The answer is that he was developing the environmental movement's strategy of promoting renewables as a way to greenwash the killing of nuclear plants and the expanded use of fossil fuels.**

At the exact same time, California's former governor, Edmund "Pat" Brown, was raising $100 billion (in 2019 dollars) from U.S. banks for Indonesia's state oil company. In exchange, he received exclusive rights to sell Indonesian oil in California and a $360,000 (in 2019 dollars) donation to his son Jerry's campaign for governor.

After he won, Gov. Jerry Brown's aides took actions to defend the family's oil monopoly. **One of them, acting as an air pollution regulator, killed a refinery being built by Chevron, which would have competed directly with the Brown oil business, while another worked to kill nuclear plants.**

By 1976, activists who feared that cheap nuclear energy would fuel overpopulation had taken over the Sierra Club. **The organization's new executive director proposed a strategy to foment hysteria about nuclear in order to impose regulations to make nuclear expensive.**

"Our campaign stressing the hazards of nuclear power will supply a rationale for increasing regulation," he explained, "add to the cost of the industry, and render its economics less attractive."

Along with groups like **Union of Concerned Scientists and NRDC, Sierra Club claimed that the clean if slightly warmer water that comes out of nuclear plants was a kind of "thermal pollution," and demanded unnecessary and expensive measures to mitigate the non-problem.**

Working together, Brown and the Sierra Club killed so many nuclear power plants between 1976 and 1979 that, had they been built, California would today be generating all of its electricity from zero-emissions sources.

Greenwashing Gas

Environmental Defense Fund (EDF) also got its start in California in the 1960s and 1970s**. It created detailed energy forecasts purporting to prove that California didn't need to build nuclear plants because it could simply reduce electricity consumption. California couldn't, and massively expanded its use of natural gas, instead.**

In the 1980s, EDF made an alliance with Wall Street and natural gas companies to deregulate electricity markets. **Along with the lack of nuclear power, deregulation resulted in the 2000 energy crisis, which allowed natural gas investors to fleece California ratepayers out of billions of dollars.**

NRDC, too, advocated deregulation and even helped natural gas giant Enron, distribute hundreds of thousands of dollars to environmental groups. "On environmental stewardship, our experience is that you can trust Enron," buzzed NRDC's Ralph Cavanagh. Enron executives at the time were defrauding investors of billions of dollars in an epic criminal conspiracy.

From 2009 to 2011, lawyers and lobbyists with EDF and NRDC advocated for and helped write mind-bogglingly complex cap-and-trade climate legislation that would have created, and allowed its Wall Street donors to take advantage of, a carbon-trading market worth upwards of $1 trillion.

Today**, EDF works with the world's largest multinational oil and gas companies** to demand changes to regulations in ways that benefit highly-capitalized firms and undercut smaller, less-capitalized competitors.

In recent years the work **of hiding outlandish assumptions about renewables and efficiency has fallen to Stanford's Mark Z. Jacobson. By simply entering numbers into an Excel spreadsheet, Jacobson managed to convince many politicians, journalists, and activists that we can power the world on 100% renewables.**

What is the source of Jacobson's funding? Why the Precourt Institute for Energy, which was founded by Jay Precourt, an oil and gas magnate and board member of Halliburton, the oil and gas services firm. The board of the Institute is a who's who of oil, gas, and renewables investors.

Today, the Sierra Club, EDF, and NRDC together take in more than half a billion dollars each year from donors that include billionaire coal, natural gas, and renewables investors like Tom Steyer and Michael Bloomberg.

Sierra Club and EDF have received a minimum of $136 million and $60 million, respectively, from oil, gas, & renewables investors, and are currently working alongside the American Petroleum Institute to kill nuclear plants in California, New York, Ohio and Pennsylvania.

NRDC, for its part, has a minimum of $70 million directly invested in oil and gas and renewable energy companies that stand to profit from the closure of nuclear plants. It, too, is working to kill nuclear plants in California, New York, Ohio, and Pennsylvania.

Even smaller groups, like WISE International and Environmental Law and Policy Center, take money from natural gas and renewables companies while fighting to replace nuclear plants with natural gas and renewables.

Friends of the Earth and Greenpeace — which rakes in $350 million annually, crashes drones into nuclear plants, and recently declared, "Sabotaging nuclear is a vital part of saving the climate" — **both keep their donors secret**.

EDF, NRDC, and Sierra Club know perfectly well that solar and wind require the expansion of fossil fuels. How could they not? They've been killing nuclear plants and watching air pollution rise, as a result, for a half-century.

Renewables advocates know that had California and Germany invested $680 billion into new nuclear power plants, instead of renewables and the grid upgrades they require, the two places would be generating 100% of their electricity from clean, zero-emission energy.

They know that Germany today spends nearly twice as much as France for electricity that produces ten times the emissions per unit of energy because France receives 75% of its electricity from nuclear while Germany is phasing nuclear out.

And they know that, after investing $33 billion over the last decade to add more solar and wind to the grid, France had to use less nuclear and more natural gas, resulting in higher electricity prices and more carbon-intensive electricity.

Sometimes on Twitter, after I point these things out, someone will quip, "A lesson in unintended consequences." But after 50 years of killing nuclear plants and promoting renewables, the main consequence of anti-nuclear advocacy — more fossil fuel pollution — can no longer be considered unintentional.

What about climate activists like AOC and Thunberg? Are they aware of the extent to which their renewable energy advocacy is a far more valuable form of natural gas greenwashing than any amount of Twitter and airport advertising? If they aren't, they should be.

Thunberg and AOC are right that we have a moral obligation to do the right thing on climate change. Unfortunately, neither of them does.

Michael Shellenberger, President, Environmental Progress. Time Magazine "Hero of the Environment."

Michael Shellenberger

Contributor

I am a Time Magazine "Hero of the Environment," Green Book Award Winner, and President of Environmental Progress, a research and policy organization. My writings have appeared in The New York Times, Washington Post and Wall Street Journal, Scientific American, Nature Energy, and PLOS Biology. My TED talks have been viewed over 1.5 million times.

Air pollution deaths are double earlier estimates: study

Marlowe HOOD
,
AFP•March 12, 2019
https://news.yahoo.com/air-pollution-deaths-double-earlier-estimates-study-100230089.html

Paris (AFP) - Air pollution causes 790,000 premature deaths every year in Europe and 8.8 million worldwide, doubling recent assessments, according to a study released Monday.

Between 40 and 80 percent of those excess deaths are caused by heart attacks, strokes and other types of cardiovascular disease underestimated up to now as a driver of smog-related mortality, researchers reported.

On average, a toxic cocktail of pollutants from vehicles, industry and agriculture shortens the lives of those who die prematurely by 2.2 years, they calculated.

"This means that air pollution causes more extra deaths a year than tobacco smoking, which the World Health Organization (WHO) estimates was responsible for an extra 7.2 million deaths in 2015," said senior author Thomas Munzel, a professor at the University Medical Centre Mainz in Germany.

"Smoking is avoidable, but air pollution is not."

Small and larger particulate matter, nitrogen dioxide (NO2), sulphur dioxide (SO2) and ozone (O3) have likewise been linked to drops in cognitive performance, labour productivity and educational outcomes.

The new study, published in the European Heart Journal, focused on Europe, but the updated statistical methods were also applied to the rest of the world.

"The revised number for China is 2.8 million deaths per year," more than two-and-a-half times current estimates, lead author Jos Lelieveld, a researcher at the Max-Plank Institute for Chemistry in Germany, told AFP by email.

Findings for non-European countries will be published separately, he said.

The scientists applied the new Global Exposure Mortality Model to a much-expanded epidemiological database -- with updated figures for population density, age, disease risk factors, causes of death -- to simulate the way in which natural and man-made chemicals interacts with the atmosphere, itself composed of gases.

By far, most deaths were attributed to microscopic particles less than 2.5 microns in diameter, known as PM2.5.

By comparison, the average human hair is 60-to-90 microns thick.

"New data has become available for fine particulate matter indicating that the hazardous health impact of PM2.5 are much larger than assumed previously," said Lelieveld.

- Burning fossil fuels -

The WHO has recommended that the density in the air of these dangerous microscopic particles should not exceed, on average, 10 microgrammes per cubic metre (35 mcg/m3) per year.

European Union standards are far more lax: 25 mcg/m3. But even at this level, several European countries regularly exceed this limit.

"The WHO standards over the last decades have become stricter," said European Environment Agency executive director Hans Bruyninckx, who was not involved in the study.

"We used to speak primarily about carcinogenic effects, or immediate impacts on the respiratory system," he told AFP. "But now we understand the link with cardio issues, brain related issues, and some reproductive issues."

Worldwide, the study found that air pollution causes an extra 120 deaths per year per 100,000 people.

In Europe, despite more stringent pollution controls than in most other regions, the figure is higher -- 133 deaths per 100,000 people.

"This is explained by the combination of poor air quality and dense population, which leads to exposure that is among the highest in the world," said lead author Jos Lelieveld, a researcher at the Max-Plank Institute for Chemistry, also in Mainz.

Even steeper rates of excess death in eastern Europe -- over 200 per year per 100,000 people, for example, in Bulgaria, Croatia and Romania -- were attributed to less advanced health care.

"Since most particulate matter and other air pollutants in Europe come from the burning of fossil fuels, we need to urgently switch to other sources for generating energy," said Lelieveld.

The 2017 Global Burden of Diseases study found that PM2.2.5 and ozone pollution caused some 4.5 million deaths in 2015, while European Environment Agency estimates, also based on 2015 data, calculated 480,000 premature deaths -- due to the three most toxic forms of air pollution -- in the European Union.

The new study "suggests earlier models underestimated the cardiovascular risk associated with air pollution, and we tend to agree," said Holly Shiels, a researcher in the Division of Cardiovascular Sciences at the University of Manchester.

"The call for reassessment of current UK and EU air quality regulations seem highly warranted."

INSIDE ENERGY
Bringing Energy Reporting Down to Earth™

CRUDE OIL

Half Century Old Pipelines Carry Oil And Gas Load

By  **Jordan Wirfs-Brock** | August 1, 2014

http://insideenergy.org/2014/08/01/half-century-old-pipelines-carry-oil-and-gas-load/

Thousands of miles of new pipeline are going into the ground across the U.S. to accommodate the current oil and gas boom, Inside Energy's Stephanie Joyce reports.

But as we build new pipeline, we are still shipping oil and gas through many of the old pipelines. Really old pipelines, in some cases. About **forty-five percent of U.S. crude oil pipeline is more than fifty years old**. Even pipeline laid into the ground in the 1920s and before (think the *There Will Be Blood* era) is still operating today.

Why does the age of a pipeline matter? Safety. Failures. Leaks. Spills. Different ages of pipeline have different safety concerns:

- Old pipe is prone to leak or fail because it is old, and because it built before construction and safety standards took effect
- New pipe because it is being built rapidly and, in some cases, shoddily.

As part of our ongoing investigations into the pipeline infrastructure, Inside Energy is looking at data to understand what is failing, and how the age of the pipeline relates to failures.

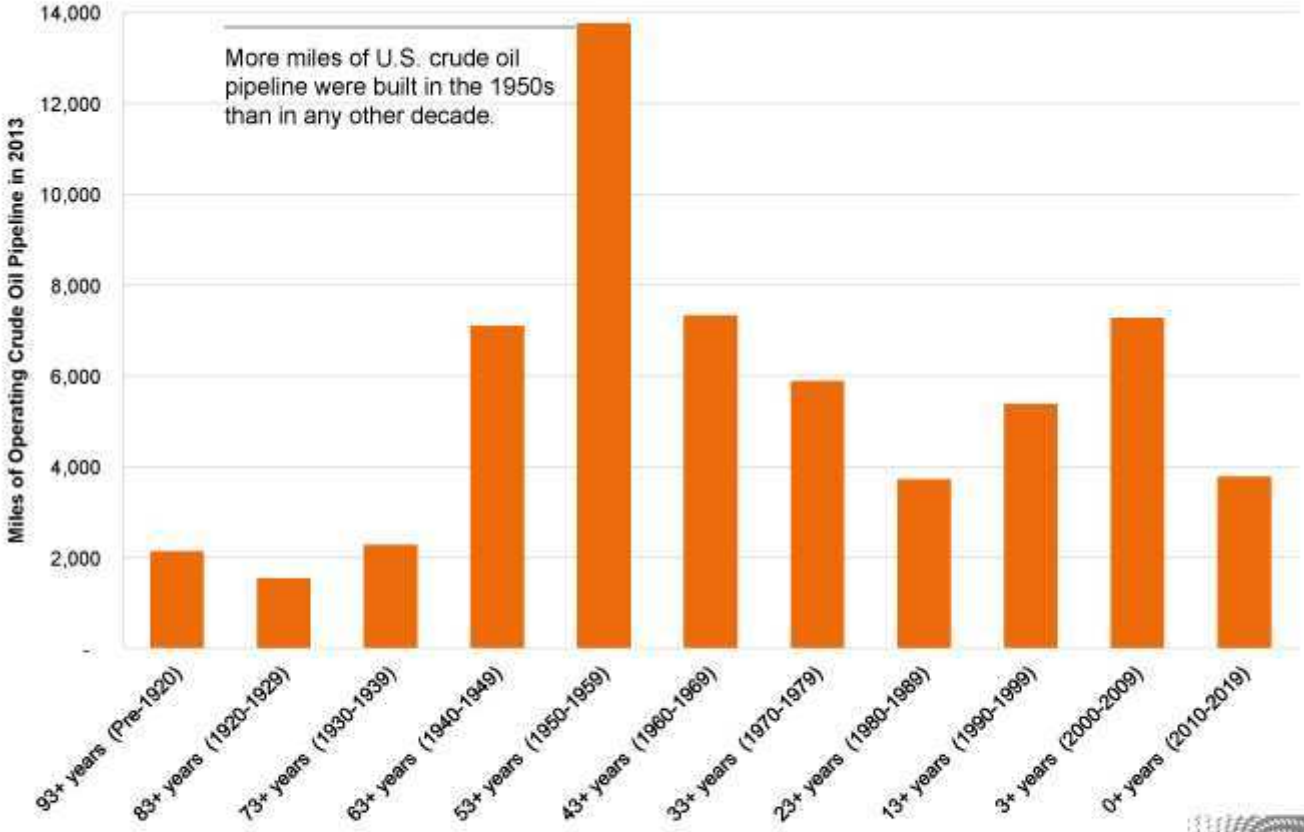
In the meantime, using data from the Pipeline and Hazardous Materials Safety Administration (PHMSA) we've created this video to highlight how the age of crude oil pipeline infrastructure varies widely state to state.

Compare Oklahoma and Arkansas, where more pipeline is from the 1940s than any other decade, to North Dakota, where more pipeline is from the 2010s – even though we're less than halfway through it – than any other decade.

Nationwide, the fifties still dominate: More operating crude oil pipeline (nearly 14,000 miles) was built in the 1950s than in any other decade. The next closest decades (the 1960s, the 2000s, and the 1940s) each only have around 7,000 miles.

This graph shows the age profile of existing U.S. crude oil pipeline:

How Old Are U.S. Crude Oil Pipelines?



Nearly half of U.S. crude oil pipeline is more than 50 years old and was built before 1960. Although we're not even halfway through the 2010s, it's already shaping up to be a major pipeline decade.

Data Source: PHMSA.

Jordan Wirfs-Brock | Inside Energy

And here's a table summarizing the age of crude oil pipeline in the U.S.:

U.S. Crude Oil Pipeline Age : Sheet1

Crude Oil Pipeline Age	Miles	Percent
93+ years (Pre-1920 or unknown)	2,138	3.6%
83+ years (1920-1929)	1,539	2.6%
73+ years (1930-1939)	2,284	3.8%
63+ years (1940-1949)	7,103	11.8%
53+ years (1950-1959)	13,756	22.9%
43+ years (1960-1969)	7,332	12.2%
33+ years (1970-1979)	5,876	9.8%
23+ years (1980-1989)	3,717	6.2%
13+ years (1990-1999)	5,371	8.9%
3+ years (2000-2009)	7,268	12.1%
0+ years (2010-2019)	3,771	6.3%

Data Source: PHMSA pipeline miles by decade, 2013 (http://opsweb.phmsa.dot.gov/primis_pdm/miles_by_decade.asp) analyzed by Inside Energy

Sheet1

Because this data only tells us the age of pipelines that are currently in use, it *doesn't* tell us is how many total miles of crude oil pipeline were built in each decade but are no longer operating.

Data Notes:

- Inside Energy downloaded 2013 hazardous liquid pipeline miles by decade from PHMSA's database.
- We then filtered for crude oil pipeline and aggregated mileage by decade and by state.
- View a the raw PHMSA data table and our analyzed data.

More

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The Pipeline Network

Inside Energy contributor Stephanie Joyce looks at how our nation's pipeline infrastructure is expanding in response to the domestic oil and gas boom.

ABOUT JORDAN WIRFS-BROCK

Jordan Wirfs-Brock was Inside Energy's first data journalist, based in Colorado. Now she's living in the San Juan Islands, but is still helping us out. When she's not wrangling data, she enjoys running up and down mountains, doodling, playing board games and brewing beer.

http://insideenergy.org/about/

About The Project

Inside Energy

What is the state of energy reporting today?

Here are some things we've heard people say about energy reporting: It's boring. It's complicated. I feel like I need a PhD or several decades of work experience in the industry to understand it. It's polarized and politicized. It doesn't matter to me.

Well, we don't think energy reporting has to be that way. In fact, we think energy is the most important topic of our time – so its imperative that energy information is accessible and engaging.

How is Inside Energy different?

Inside Energy brings energy reporting down to earth. We look at how energy is made, moved and used, by telling the stories of the people involved. We show you how energy is part of your daily life. And we answer the questions you've always had about energy but were afraid to ask.

What is Inside Energy's approach?

We go deep into stories using investigative and data-driven techniques. And we pride ourselves as much in our storytelling as in our reporting. We bring you stories on complex topics that are clear, approachable, and yes, even fun.

Corporation for Public Broadcasting

How did the project start?

Inside Energy is a collaborative journalism initiative among public media with roots in Colorado, Wyoming and North Dakota and growing to include other states. We are funded by a grant from the Corporation for Public Broadcasting.

Mission Statement

The mission of Inside Energy, in collaboration with its partner stations, is to create a more informed public on energy issues. We seek to make energy issues a household topic and to inspire community conversations on the topic of energy. We strive to create a deeper understanding and appreciation of how energy is a part of every aspect of our modern life and how our choices in energy consumption impact the world around us. To this end, Inside Energy uses data and investigative reporting techniques to produce intelligent and approachable stories on how we make energy, move energy and use energy; stories that meet the highest standards of public service in journalism.

We are honest and respectful in our reporting and storytelling and work to be balanced, independent and impartial. Our reporting and research methods are transparent. Our data analysis and sources are published and available alongside each of our investigative stories. Inside Energy is accountable for all we produce.

Foundational and Ongoing Funding

Inside Energy was launched with a two-year, $1.4 million startup grant from the Corporation for Public Broadcasting. IE pursues ongoing and sustaining partnership funding through individuals, foundations, corporations, businesses and organizations that share an interest in the national and local energy discussion.

The Inside Energy Team

Inside Energy is uniquely situated to lead important national energy conversations. The expertise of the Inside Energy newsroom includes an executive supervisor, an editorial leader, a project manager and a host of journalists, data specialists, broadcast talent and digital/social media professionals.

The public media organizations that comprise Inside Energy represent states that run the gamut of energy production and research in the U.S. These states produce or extract oil, gas, coal, wind, solar, geothermal and biofuels. They host examples of emerging, booming, mature and declining energy ecosystems. And they're home to renowned research institutions, including the National Renewable Energy Laboratory and the Institute for Energy Research.

Become an Energy Insider today to keep up with expert level reporting on the energy issues that matter to you the most.

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Inside Energy is growing and we're seeking additional partners who would like to become part of a strong network of quality energy coverage across the country. We're creating a central clearinghouse and repository for public media coverage of energy.

If you'd like to air our radio and TV news features and series, and augment your broadcast or website with our video content, please read our content sharing agreement and **contact Executive Editor Alisa Barba, abarba@insideenergy.org**. Ask Alisa about our free "evaluation phase," during which IE content costs you nothing.

Natural Gas Pipeline and Infrastructure Explosions Nationwide

https://www.greenamerica.org/fight-dirty-energy/fighting-pipelines/natural-gas-pipeline-and-infrastructure-explosions-nationwide

Source: Photographer

Natural Gas pipelines explode with alarming frequency in the US, killing and injuring people, and causing millions of dollars in damage. Interstate pipelines are permitted by the Federal Energy Regulatory Commission (FERC), which has approved all but one pipeline over the past 30 years, and routinely rejects legitimate concerns raised by impacted communities.

In just the past two years, there have been 12 deaths and 10 injuries reported from natural gas pipelines in the US. Pipeline explosions also cause millions of dollars in damage and evacuations. This list does not include the many injuries, deaths, and extensive property damage reported from natural gas explosions reported at homes, apartment buildings, businesses, from local natural gas infrastructure.

From **June 2015 to June 2017**, the following incidents have been documented

February 17, 2017: A natural gas pipeline operated by Kinder Morgan in Refugio Texas exploded creating a massive fire. The explosion shook homes 60 miles away.

February 10, 2017: A natural gas pipeline operated by Phillips 66 Pipeline in St. Charles Parish, LA exploded, injuring 3 workers.

February 1, 2017: A DCP pipeline in Panola County TX exploded and created a crater in an airport runway, shutting down the airport for a month.

January 17, 2017: A natural gas pipeline operated by DCP Midstream exploded in Spearman, TX, which led to multiple fire crews being called to the scene.

August 20, 2016: 10 people in New Mexico were killed when they were camping near an underground natural gas pipeline operated by El Paso Energy that suddenly exploded.

April 18, 2016: 2 workers were killed when they struck a pipeline at the Southcross Gas Processing Plant in Bonnie View, TX.

April 29, 2016: A 30-inch pipeline in Salem Township, operated by Spectra, exploded, severely injured a worker, and caused the evacuation of local businesses and homes.

January 9, 2016: A 30-inch pipeline operated by Atmos Energy in Robertson County, TX exploded and forced the evacuation of several families.

August 26, 2015: Two workers were injured when a Boardwalk/Gulf South Pipeline Co underwater pipeline off the coast of Louisiana ruptured and exploded.

June 27, 2015: Four workers were injured when a pipeline exploded at a gas booster station in White Deer Texas.

June 17, 2015: A pipeline operated by Energy Transfer Partners ruptured in Cuero, TX and caused a massive blaze and the evacuation of 7 families. 165,732 pounds of volatile organic compounds may have burned.

The incidents documented above represent a continuation of and ongoing trend of repeated natural gas pipeline disasters in the US

From 2010 to 2016 -- Gas companies reported 35 explosions and 32 ignitions at their transmission pipelines, according to federal records. The explosion killed 17 people and injured 86. A September 2010 explosion in San Bruno, Calif., killed eight and injured 51 people.

Dangers From Liquified Gas

In addition to pipeline explosions, there are risks from compressor stations and liquefied natural gas export facilities, including a 2014 explosion at a rural Washington State LNG storage facility that injured several workers and resulted in evacuations. The explosion called into question the safety of LNG storage facilities located near population centers nationally

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https://archive.triblive.com/local/westmoreland/man-burned-in-salem-twp-gas-line-explosion-homes-businesses-evacuated/
Salem Township, Westmoreland County, Pennsylvania

Man burned in Salem Twp. gas line explosion; homes, businesses evacuated

Tribune-Review Contributed Photograph of natural gas line explosion

Fri., April 29, 2016 8:39 a.m. | Friday, April 29, 2016 8:39 a.m.

Sidebar article

Transmission line blasts kill

Gas companies reported 35 explosions and 32 ignitions at their transmission pipelines since 2010, according to federal records. During that same time period, 17 people died and 86 were injured in incidents involving the pipelines, including a September 2010 explosion in San Bruno, Calif., that killed eight and injured 51.

Transmission lines ferry gas across the country, feeding the utility companies that then send gas to homes and businesses through smaller pipes known as distribution lines. Transmission lines are often far larger " and operate at far greater pressure " than the distribution lines that lead to homes and businesses.

In all, gas companies estimate incidents involving transmission pipelines have caused nearly $1 billion in damage since 2010. The damage caused by the San Bruno blast alone amounted to more than $558 million, according to figures the gas companies are required to report to federal regulators.

Residents affected by the explosion can call Texas Eastern Transmission's community hotline at 855-210-7732.

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PHMSA
Pipeline and Hazardous Materials Safety Administration

Pipeline Enforcement Guidance

Enforcement Guidance documents are available to clarify PHMSA's enforcement authority by identifying and summarizing precedent, including those from interpretations, advisory bulletins, final orders, and decisions on petitions for reconsideration. The material contained in these documents describe the practices used by PHMSA personnel in undertaking their compliance, inspection, and enforcement activities. This guidance facilitates improved enforcement consistency and is particularly helpful when precedence exists for clarifying performance-based requirements.

Corrosion Enforcement Guidance
Corrosion Enforcement Guidance Part 192 (12/7/2015)
Corrosion Enforcement Guidance Part 195 (6/22/2016)
Integrity Management Enforcement Guidance
DIMP Enforcement Guidance (12/7/2015)
Gas Integrity Management Enforcment Guidance (12/7/2015)
Hazardous Liquid Integrity Management Enforcment Guidance (12/7/2015)
Operations & Maintenance Enforcement Guidance
O-M Enforcement Guidance Part 192 (7/21/2017)
O-M Enforcement Guidance Part 195 (7/21/2017)
Operator Qualification Enforcement Guidance
Operator Qualification Enforcement Guidance (8/25/2016)
Public Awareness Enforcement Guidance
Public Awareness Enforcement Guidance Part 192 (12/7/2015)
Public Awareness Enforcment Guidance Part 195 (12/7/2015)

Updated: Friday, October 19, 2018

U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, DC 20590
202-366-4433 HAZMAT Registration: 1-800-467-4922

List of pipeline accidents

The following is a **list of pipeline accidents**

Contents

Belgium

- 2004: A major natural gas pipeline exploded in Ghislenghien, Belgium near Ath (50 kilometres southwest of Brussels), killing 24 people and leaving 122 wounded, some critically on July 30, 2004.[1]

Canada

- 1962: An explosion on a gas pipeline occurred on a lateral line on January 17, about 50 kilometers northwest of Edson, Alberta. 8 people were killed.[2][3]
- 1965: An explosion from a gas line destroyed several apartments in the LaSalle Heights Disaster in LaSalle, Quebec killing 28 people, the worst pipeline disaster in Canadian history
- 1965: On October 12, an explosion & fire involved the Albert Gas Trunk Line LTD. near Sundre, Alberta, killing 2 pipeline workers.[4]
- 1969: On October 25, a faulty pipe exploded in a gas line beneath Malton, Ontario. One person died, about 20 were injured, 9 stores and several homes were destroyed. Gas in a dead end section of gas pipeline.[5]
- 1986: On October 27, a butane pipeline was hit by a pipeline crew in Sarnia, Ontario; 4 workers were injured (one critically).[6]
- 1996: On April 15, a rupture, followed by an explosion and fire at 1829 EST, occurred on the TransCanada PipeLines Limited 864-millimetre (34-inch) natural gas pipeline, at Kilometre Post Mainline Valve 39-2 + 6.07 kilometres, 10 kilometres southwest of Winnipeg, near the town of St. Norbert, Manitoba.[7]
- 1997: On April 30, a rupture occurred on the Westcoast Energy Inc. 219.1-millimetre (8-inch) outside diameter Monias pipeline at Mile Post 20, near Fort St. John, British Columbia. Approximately 85,000 cubic metres of sour natural gas was released and ignited.[8]

- 1997: On December 2, a rupture occurred at an area of external corrosion on the TransCanada PipeLines Limited 914-millimetre outside diameter Line 100-3 at main line valve 5-3 + 15.049 kilometres, near Cabri, Saskatchewan. Approximately 3 252 × 10^3 cubic metres of natural gas was released as a result of the rupture. The gas ignited immediately resulting in damage to the surrounding soil and vegetation. The main fire self-extinguished within 20 minutes of the line break.[9]
- 1999: On May 20, Line 3 on the Enbridge Pipelines Inc. (Enbridge) pipeline system ruptured, releasing 3 123 cubic metres (m3) (20,600 barrels) of Cold Lake heavy crude oil, east of Regina, Saskatchewan. Approximately 3.6 hectares (ha) (8.8 acres) of farmland was affected by crude oil.[10]
- 2000: On December 28, a release of natural gas resulted in an explosion that destroyed the electrical and services building, heavily damaged the compressor building, and damaged the remaining buildings at the East Hereford compressor station, approximately 80 km SE of Magog, Quebec. Before the occurrence, the station had been shut down due to an unintentional manual initiation of the station's emergency shutdown system. Following the emergency shutdown of the compressor station, a maintenance person was sent to the station to reinitiate the electric motor-driven compressor unit. During the day, after repeatedly trying to get the station into the ready state mode, to return the station to normal pipeline operations, an explosion occurred. The on-site maintenance person was seriously injured.[11]
- 2001: On January 17, a rupture occurred on the Enbridge Pipelines Inc. 864-millimetre outside diameter Line 3/4 at Mile Post 109.42, 0.8 kilometres downstream of the Hardisty pump station near Hardisty, Alberta. The rupture occurred in a permanent slough that was fed by an underground spring. Although the line was shut down at the control centre in Edmonton, Alberta, within minutes of the rupture, the exact location of the rupture was not found

until after 13 hours. Approximately 3800 cubic metres of crude oil was released and contained within a 2.7-hectare section. As of 01 May 2001, 3760 cubic metres of crude oil had been recovered.[12]

- 2001: On September 29, a rupture occurred on the Enbridge Pipelines Inc. 508-millimetre outside diameter Line 10 at Mile Post 1885.64, near Binbrook, Ontario. Line 10 transports crude oil from Westover, Ontario, to Buffalo, New York, United States. The rupture occurred in an agricultural field planted with soybeans. Within eight minutes of the rupture, the control centre operator in Edmonton, Alberta, shut the line down and began to sectionalize it. Remedial action response teams contained the spill to two general areas, a natural swale running perpendicular to the pipeline and the pipeline trench. Approximately 95 cubic metres of crude oil were released, affecting a 0.67-hectare section of land.[13]
- 2002: On April 14, a rupture occurred on the 914-millimetre-diameter natural gas transmission pipeline, at a zone of near-neutral (low) pH stress corrosion cracking, on Line 100-3 of the TransCanada PipeLines, at main-line valve 31-3 + 5.539 kilometres, approximately two kilometres from the village of Brookdale, Manitoba. Following the rupture, the sweet natural gas ignited. With the automatic closure of main-line valves upstream and downstream of the rupture site, the fire self-extinguished at 0230, on 15 April 2002. There were no injuries. As a precautionary measure, approximately 100 people were evacuated from the occurrence area within a four-kilometre radius, including the village of Brookdale, for a period of one day.[14]
- 2002: A refined product pipeline rupture near Saint-Clet, Quebec, on Dec 7, from Trans Northern Pipelines Inc 273.1 mm diameter mainline kilometer post 63.57, estimated 32 cubic meters of low sulphur diesel released to area and drainage systems. Transportation Safety Board Investigation Report Number P02H0052. http://www.tsb.gc.ca/eng/rapports-reports/pipeline/2002/p02h0052/p02h0052.asp
- 2003: A backhoe punctured a pipeline in Etobicoke, Ontario, the resulting explosion killed 7 people
- 2005: On July 15, an employee of Terasen Pipelines (Trans Mountain) Inc. discovered crude oil on the pipeline right-of-way, on the north side of Ward Road, Abbotsford, British Columbia. Before the discovery, the company had been delivering crude oil out of the Sumas Tank Farm, when it received odour complaints from local residents. Approximately 210 cubic metres of crude oil was released into the surrounding area and made its way into Kilgard Creek. There were no injuries.[15]
- 2007: A crude oil pipeline owned and operated by Kinder Morgan Energy Partners was ruptured by an excavator digging a storm sewer trench in Burnaby, British Columbia.[16]
- 2007: On 15 April, a rupture occurred on Enbridge Pipelines' 864-millimetre outside diameter Line 3 at Mile Post 506.2217 downstream of the Glenavon pump station near Glenavon, Saskatchewan. The rupture occurred in a wetland area of farmland. Approximately 990 cubic meters of crude oil were released, of which approximately 912 cubic meters were recovered. There were no injuries. The cause was determined to be corrosion cracking.[17]
- 2007: On July 24, the 610-millimetre (24-inch) Westridge Dock Transfer Line, owned by Trans Mountain Pipeline L.P. and operated by Kinder Morgan Canada Inc., was struck and punctured by a contractor's excavator bucket while the contractor was excavating a trench for a new storm sewer line along Inlet Drive in Burnaby, British Columbia. When the pipeline was punctured, approximately 234 cubic metres of crude oil was released, approximately 210 cubic metres of which was recovered. Crude oil flowed into Burrard Inlet Bay via the Burnaby storm sewer system. Eleven houses were sprayed with crude oil; many other residential properties required restoration and approximately 250 residents voluntarily left their homes. There were no explosions, fires, or injuries resulting from this occurrence; however, emergency workers and two firefighters responding to the incident were sprayed with crude oil. Two members of the public were also sprayed.[18]
- 2009: A July 20 Alberta pipeline explosion & fire involved a TransCanada Corporation natural gas pipeline. The explosion, which sent 50 meter flames into the air, destroyed a two-hectare wooded area. The NEB said the delay in releasing the report was caused by an "administrative error", when an employee left without transferring the file over. The Peace River Mainline pipeline, built in 1968, had ruptured six times and leaked on 17 occasions until 2014. The line ruptured in 2009 due to corrosion.[19]
- 2009: On 12 September 2009, TransCanada Corporation's Gas Control received notification, from the Englehart Fire Department through its Emergency Notification Line, of an explosion and fire south of its Compressor Station 107, located near Swastika, Ontario. At the time of the occurrence, TransCanada was transporting sweet natural gas. Escaping gas from a pipeline rupture had ignited, resulting in the explosion. A large crater was created and two sections of pipe broke from the system, with one section being ejected approximately 150 metres from the rupture site. There were no injuries.[20]
- 2009: On 26 September 2009, TransCanada Corporation's Line 100-1 ruptured, near Marten River, Ontario. At 1151, Gas Control at TransCanada's Calgary office became aware of this event when Main Line Valve 112-1, on the upstream side of Compressor Station 112, automatically shut off due to low pipeline pressure. At the time of the occurrence, TransCanada was transporting sweet natural gas. The escaping gas did not ignite. A large crater was created and pipe pieces were ejected from the failed pipeline section and spread around the occurrence site. There were no injuries.[21]
- 2009: On 29 September, an Enbridge crude oil pipeline, Line 2, leaked at Mile Post 474.7335, immediately downstream of the Odessa pump station near Odessa, Saskatchewan. The leak occurred at a crack within a shallow dent at the 6 o'clock position on the pipe. There were indications of gouging associated with the dent. The release occurred in a low lying, densely vegetated marsh. Approximately 175 cubic meters of crude oil was released, of which most was recovered. There were no injuries.[22]

- 2009: A refined product pipeline rupture near Farran's Point, Ontario on Ottawa Lateral, on October 5, from the Trans Northern Pipelines Inc. system, unknown petroleum product, unknown quantity. Transportation Safety Board Report Number P09H0086. http://www.tsb.gc.ca/eng/rapports-reports/pipeline/2009/p09h0086/p09h0086.asp
- 2010: A refined product pipeline rupture at Bronte Creek in Oakville, Ontario, detected on March 11, from the Trans Northern Pipeline Inc. system, estimated 23,770 gallons of gasoline released to creek, soil and ground water. Transportation Safety Board Report Number P10H0021. http://www.tsp.gc.ca/eng/rapports-reports/pipeline/2010/p10h0021/p10h0021.asp
- 2011: On February 19, TransCanada PipeLines Limited's gas control operator received notification through its emergency notification line of a pipeline fire and explosion, near Beardmore, Ontario. At the time of the occurrence, TransCanada was transporting sweet natural gas. Escaping gas from a pipeline rupture had ignited, resulting in the explosion. A large crater was created and three pieces of pipe broke from the system, with pipe and other debris being ejected up to 100 m from the rupture site. Six residents near the site evacuated until the fire was extinguished. There were no injuries.[23]
- 2011: In April, a pipeline break northeast of Peace River, Alberta, leaked 28,000 barrels of crude oil, Some wildlife was killed from the spill. The Energy Resources Conservation Board, an independent government agency that was dissolved in 2013, reprimanded the company, saying it had inadequate leak detection and failed to test its emergency response plan.[24]
- 2012: In June, almost half a million liters of sour crude oil leaked into a creek that flows into the Red Deer River, located about 100 kilometers north of Calgary, near the community of Sundre.[25]
- 2012: On June 19, an Enbridge pipeline had a gasket failure, spilling about 1,400 barrels of crude oil, at a pumping station near Elk Point, Alberta.[26]
- 2012: On June 23, an ignition and fire occurred in a valve-enclosure structure at Spectra Energy Transmission Compressor Station N4, located approximately 160 km northwest of Fort St. John, British Columbia. Two maintenance employees sustained burn injuries when sweet natural gas that had been leaking from a station valve ignited. The 2 employees were performing annual inspection work on motor-operated valves. The injured employees were air-lifted to the Fort St. John Hospital. One employee was released later that day, while the second employee was transferred to a burn unit in Vancouver.[27]
- 2012: On June 28, a pipeline rupture and ignition occurred on Westcoast Energy Inc.'s 406.4 mm (16-inch) Nig Creek pipeline, located about 40 km northwest of Buick, British Columbia. Approximately 25 minutes later, a pipeline rupture and ignition occurred on Bonavista Energy Corporation's 168.3 mm (6.625-inch) pipeline installed nearby in the same right-of-way. At the time of the ruptures, both pipelines had been shut down and contained pressurized sour gas. The fire spread to adjacent forested areas. A large crater was created, and one piece of the Nig Creek pipe was ejected along with other debris to approximately 20 m from the rupture site. There were no injuries and no evacuation was required.[28]
- 2013: In June, between 400,000 and 600,000 liters of produced water escaped from a pipeline, in addition to 5,000 liters of oil, near Little Buffalo, Alberta.[29]
- 2013: On October 17, a 36-inch natural gas pipeline ruptured southwest of Fort McMurray, Alberta. An estimated 16.5 million cubic meters of natural gas were released. The rupture did not result in a fire, there were no injuries and no evacuation was required. A fracture in a pipe elbow was the identified for the reason of the failure.[30]
- 2014: On January 25, a TransCanada Corporation gas transmission pipeline 762 mm (30-inch) Line 400-1 exploded and burned, near Otterburne, Manitoba, causing a natural gas shortage in Manitoba and parts of the United States. Natural gas burned for approximately 12 hours. Five residences in the immediate vicinity were evacuated, and Provincial Highway 303 was closed until the fire was extinguished. There were no injuries.[31][32]
- 2014: On April 2, a pipeline failed, and spilled 70,000 liters of oil and processed water, northwest of Slave Lake, Alberta.[33]
- 2014: In November, 60,000 liters of crude oil spilled into muskeg from a failed pipeline, in Red Earth Creek in northern Alberta. Officials were delayed in reaching the scene, due to poor weather at the time.[34]
- 2015: On March 1, a pipeline leak spilled about 17,000 barrel of condensate, in Northern Alberta.[35]
- 2015: On May 5, a gas transmission pipeline failed approximately 36 kilometers southeast of Drumheller, Alberta. The incident resulted in an undetermined volume of sweet natural gas and associated hydrocarbon liquid being released onto agricultural land.[36]
- 2015: On July 15, a pipeline at a Long Lake oil sands facility in northern Alberta leaked about 31,500 barrels of oil emulsion. The spill covered approximately 16,000 square meters (4 acres) but was mostly contained within the pipeline's right of way.[37]
- 2015: On August 14, a leak from a pipeline spilled about 100,000 liters of an oil, water & gas emulsion on the Hay Lake First Nation, about 100 kilometers northwest of High Level, Alberta.[38]
- 2016: On July 21, a leaking Husky Energy pipeline spilled 225,000 liters of oil into the North Saskatchewan River, prompting a massive cleanup.[39]
- 2017: On February 17, a total of 200,000 liters of oil condensate in Strathcona County, Alberta were released from line 2A, near Anthony Henday Drive and 92 Avenue,[40] after line was struck during 3rd party construction operations.[41]

- 2018: On January 7, a butane oil pipeline ruptured in St. John, New Brunswick. About 30 homes in the area were evacuated, as well as the SPCA Animal Rescue League Shelter.[42]
- 2018: On May 27, a Trans Mountain pipeline leaked at the company's Darfield station north of Kamloops, British Columbia. About 4,800 liters of crude were released.[43]
- 2018: On Oct 9, a 36 inch Enbridge natural gas pipeline exploded 13 km north of Prince George, British Columbia. About 1 million BC customers and 750,000 US customers are affected. Natural gas customers are being asked to reduce use.[44]

China

- 2010: Dalian Pipeline disaster - The explosion of two petroleum pipelines and subsequent fire in the port of Dalian, in northern China's Liaoning province on Saturday, on July 17, 2010, caused fatalities, damages and an ecological disaster, releasing 11,000 barrels of oil into the Yellow Sea, and covering up, according to different sources, from 50 to 430 km^2 of sea and coast lines.
- 2013: a Sinopec Corp oil pipeline exploded in Huangdao, Qingdao, Shandong Province, on November 22, 2013. 55 people were killed.[45]

India

- 2014: On June 27, a pipeline blast in Southern Indian state of Andhra Pradesh killed 22 people and injured 37. The pipeline was operated by Gas Authority of India Limited (GAIL) and a preliminary investigation revealed faulty operational procedures as a cause of fire.[46][47]
- 2017: On April 29, a fire broke out in a GAIL operated gas pipeline caused by civil construction operations.[48]
- 2017: On June 17, a farm near city of Jamnagar was flooded with oil. An oil pipeline operated by Indian Oil Corporation Limited (IOCL) since 1999 was ruptured below 12 feet from the ground.[49]

Indonesia

- 2006: On Wednesday, October 18 a gas pipeline explosion killed at least seven people in East Java. The explosion was a consequence of land subsidence caused by volcanic mud eruptions, known as the Sidoarjo mud flow that began erupting in late May and early June at the site of the Banjar-Panji 1 exploration well drilled by PT Lapindo Brantas.[50]

Kenya

- 2011 Nairobi pipeline fire kills approximately 100 people and hospitalized 120.

Malaysia

- 2014: PETRONAS gas pipeline explosion in the state of Sarawak, Malaysia ripped apart a portion of the RM3 bil Sabah to Sarawak interstate gas pipeline between Lawas town and Long Sukang in the northernmost district of Sarawak at 2 a.m., resulting in the evacuation of nearby villagers.[51]

Mexico

- 1959: On July 1, a petroleum pipeline exploded, and burned for 7 hours in Coatzacoalcos. 12 people were killed, and 100 more injured.[52][53]
- 1978: On November 1, a gas pipeline exploded and burned, killing 52 people in colonia Benito Juarez, Mexico, and injuring 11 in a town of only 100 people. The failure created a crater 300 feet wide and 20 feet deep.[54][55]
- 2010: The explosion on December 19, 2010 of an oil pipeline at a Petroleos Mexicanos (Pemex) pumping station in San Martín Texmelucan de Labastida in central Mexico, killed at least 27 people and injured more than 50. The explosion is believed to have been caused by attempts to puncture the pipe to steal oil.[56]
- 2012: On September 18, 2012, twenty-two workers died when a gas leak from a Kinder Morgan pipeline at Reynosa, Tamaulipas, Mexico sparked an explosion which became a fireball that overtook workers running for their lives, lead plaintiff Javier Alvarez del Castillo said. "They were engulfed in fire that burnt and singed every inch of skin from their head to their ankles, taking every bit of hair from their head, laying the plaintiffs 'skinless,' like skeletons bare to the

bones, with in most cases only their footwear attached to the only portion of their body not reduced to skeleton. He blamed Kinder Morgan for not adding enough of the odorant methyl mercaptan to the gas. (Natural gas is odorless, so energy companies add the sulfur compound to make leaks smelly and therefore noticeable.) "A gas company may be liable if facts show that it fails to act reasonably after having notice of defects in the pipes through which gas flows," the ruling states, citing the Texas appellate court case Entex, a Division of NorAm Energy Corp. v Gonzalez.[57] On July 13, 2016, a U.S. Federal Court ruled that only Kinder Morgan and not any of the other companies originally sued by plaintiffs' groups should face the charges of gross negligence and negligence.[58] The cause of the leak was a valve that apparently failed as workers performed routine testing, but gaps remain in what is known about the events that led up to the Reynosa explosion.[59]

- 2019: On 18 January 2019, a pipeline transporting gasoline exploded in the town of Tlahuelilpan, in the Mexican state of Hidalgo killed at least 96 people and injured dozens more.[60][61] The explosion is believed to be related to the government crackdown on fuel thieves.[62]

Nigeria

- 1998: At Jesse in the Niger Delta in Nigeria, a petroleum pipeline exploded killing well over 500 villagers, some of whom were scavenging gasoline. The worst of several similar incidents in this country.[63] (October 18, 1998)
- 2000: Another pipeline explosion near the town of Jesse killed about 250 villagers.[63] (July 10, 2000)
- 2000: At least 100 villagers died when a ruptured pipeline exploded in Warri.[63] (July 16, 2000)
- 2000: A leaking pipeline caught fire near the fishing village of Ebute near Lagos, killing at least 60 people.[63] (November 30, 2000)
- 2003: A pipeline punctured by thieves exploded and killed 125 villagers near Umuahia, Abia State.[63] (June 19, 2003)
- 2004: A pipeline punctured by thieves exploded and killed dozens of people in Lagos State.[63] (September 17, 2004)
- 2006: An oil pipeline punctured by thieves exploded and killed 150 people at the Atlas Creek Island in Lagos State.[64] (May 12, 2006)
- 2006: A vandalised oil pipeline exploded in Lagos. Up to 500 people may have been killed.[65] (December 26, 2006)
- 2008: The 2008 Ijegun pipeline explosion (May 16)
- 2016: Vandalism at the Akulagba pipeline in Warri South - West Local Government Area of Delta State (January 22, 2016)[66]
- 2016: The Fire explosion at Arepo and other coastal communities Pipeline in Ogun State (July 29, 2016)[67]

Russia

- June 1982 Trans-Siberian Pipeline, three kilotons,[68] via Farewell Dossier (Siberian pipeline sabotage)
- 1989 The Ufa train disaster. Sparks from two passing trains caused gas leaking from an LPG pipeline near Ufa, Russia to explode. Workers with the pipeline noticed pressure dropping in the line, but they increased pressure instead of searching for a leak. Trees up to 4 kilometers away were felled by the blast, and 2 locomotives and 38 passenger cars on the trains were derailed. Up to 645 people were reported killed on June 4, 1989.[69]
- 2018 On January 18, a monstrous blaze resembling a wall of fire has engulfed a village in Russia's southern Saratov region after an oil transit pipeline sprung a leak. The flames raged for hours, devastating several houses. Some 2,000 cubic meters of oil spilled over to the adjacent territory and flooded several streets of the neighboring Krasnoarmeiskoe village in Russia's Volga region. The oil then caught fire. No casualties were reported, according to Russian media, citing “preliminary reports” of the emergency services.[70]

Taiwan

- 2014: On the night of July 31, a string of explosions originating in buried gas pipes occurred in the city of Kaohsiung. Leaking gas, suspected to be propylene, filled the storm drains along several major thoroughfares and the resulting explosions turned several kilometers of road surface into deep trenches, sending vehicles, people and debris high into the air and igniting fires over a large area. At least 30 people were killed and over 300 injured.[71][72][73]

United States

From 1994 through 2013, the U.S. had 745 serious incidents with gas **distribution**, causing 278 fatalities and 1059 injuries, with $110,658,083 in property damage.[74]

From 1994 through 2013, there were an additional 110 serious incidents with gas **transmission**, resulting in 41 fatalities, 195 injuries, and $448,900,333 in property damage.[75]

From 1994 through 2013, there were an additional 941 serious incidents with gas **all system type**, resulting in 363 fatalities, 1392 injuries, and $823,970,000 in property damage.[76]

A recent Wall Street Journal review found that there were 1,400 pipeline spills and accidents in the U.S. 2010–2013. According to the Journal review, four in every five pipeline accidents are discovered by local residents, not the companies that own the pipelines.[77][78]

Explosion details

- 1965 (March 4) A 32-inch gas transmission pipeline, north of Natchitoches, Louisiana, belonging to the Tennessee Gas Pipeline exploded and burned from Stress corrosion cracking (SCC) on March 4, killing 17 people. At least 9 others were injured, and 7 homes 450 feet from the rupture were destroyed. The same pipeline had also had an explosion on May 9, 1955, just 930 feet (280 m) from the 1965 failure.[79][80]
- 1999 (June 10) An Olympic gasoline pipeline ruptured near Bellingham, Washington, resulting in 3 deaths: a fly fisherman and two 10-year-old boys. The cause was a series of errors and malfunctions in relief systems and process control computer systems in the Olympic Pipeline system, resulting in 277,000 gallons of gasoline spilled to Whatcom Creek. The fire burned for five days.[81][82]
- 2000 (19 August) A 30-inch El Paso Energy natural gas pipeline exploded, killing twelve people in southeast New Mexico. They were camping under a bridge which carried the pipeline across the Pecos River. The explosion occurred underground on the east side of the river 200 to 300 yards from the campers around 5:30 a.m.. The explosion left a crater 86 feet long, 46 feet wide and 20 feet deep. The fireball was visible 20 miles north in Carlsbad N.M. The pipeline was installed in 1950.[83]
- 2004 (May 24) A pinhole-sized leak caused by wear unleashed thousands of gallons of gasoline that fueled the BP / Olympic pipeline fire and explosion near the Westfield Shoppingtown Southcenter in Renton, Washington. The blaze sent three firefighters to the hospital, and a mile-square area, which included a nearby fire station, was cordoned off. The leak occurred in a half-inch-wide tube of stainless steel that Olympic operators use to extract fuel samples from the system's 16-inch-wide main line. A metal electrical conduit had rubbed against the stainless steel sampling tube to open the pinhole leak.[84]
- 2010 (September 9) The San Bruno pipeline explosion. At 6:11 PM, a PG&E 30-inch natural gas line exploded in San Bruno, California, killing 8. Eyewitnesses reported the initial blast "had a wall of fire more than 1,000 feet high".[85]
- 2010 (July 25) Crude oil pipeline ruptures near Marshall, Michigan, spilling over 840,000 gallons of oil into the Kalamazoo River.[86][87]
- 2012 (12 December) a 20-inch transmission line owned by NiSource Inc., parent of Columbia Gas, exploded, leveling 4 houses, between Sissonville and Pocatalico in Kanawha County, West Virginia (WV). When it blew, nobody at pipeline operator, Columbia Gas Transmission knew it. An 800' section of I-77 was obliterated.[88][89] "The fire melted the interstate and it looked like lava, just boiling." Later the West Virginia Public Service Commission released several pages of violations by Columbia Gas.[90] Forty families were "impacted" by the explosion.[91][92] The investigation cited "external corrosion" as the cause of the blast.[93][88][94]
- 2013 (29 March) ExxonMobil pipeline carrying Canadian Wabasca heavy crude from the Athabasca oil sands ruptured in Mayflower, Arkansas, about 25 miles northwest of Little Rock. Approximately 12,000 barrels (1,900 m3) of oil mixed with water had been recovered by March 31. Twenty-two homes were evacuated.[1] The United States Environmental Protection Agency (EPA) classified the leak as a major spill. A reported 5,000–7,000 barrels of crude were released.[95]
- 2013 (20 August) Explosion of a natural gas pipeline near Kiowa southwest of Oklahoma City.[96]
- 2013 (8 October) Explosion of a natural gas pipeline near Rosston, Oklahoma.[97]
- 2014 (Jan 25) A Trans Canada pipeline about 15 miles south of Winnipeg ruptured and exploded. The incident prompted the precautionary closure of two nearby pipelines. The pipelines supply the main source of natural gas to more than 100,000 Xcel Energy customers in eastern North Dakota, northwestern Minnesota and western Wisconsin.[98] The explosion happened near Otterburne, Manitoba, about 15 miles south of the provincial capital, Winnipeg. The area was evacuated as a precaution. No injuries were reported but the fire burned for more than 12 hours.[99]
- 2014 (Feb) In Knifely, Adair County, Kentucky, a Columbia Gulf gas pipeline exploded at 1 a.m. flattening homes, burning barns, and causing one casualty. The 30-inch natural gas pipeline was about 100 feet from Highway 76 and buried 30 feet underground. When it exploded, large rocks and sections of pipeline flew into the air, leaving a 60-foot crater. Columbia Gulf, part of NiSource's Columbia Pipeline Group, owns and operates more than 15,700 miles of natural gas pipelines, one of the largest underground storage systems in North America. The pipeline that exploded was carrying natural gas from the Gulf of Mexico to New York.[100]

- 2014 (Feb 11) A Hiland gas pipeline exploded about six miles south of Tioga, North Dakota. Hiland was "blowing" hydrates, ice-like solids formed from a mixture of water and gas that can block pipeline flow, out of the pipeline.[101]
- 2014 (Mar 14) A Northern Natural Gas Company pipeline erupted near the intersection of county roads 20 and O, about six miles north of Fremont, Nebraska. A company spokesman said, "In the summer you can tell if you've got a gas leak by vegetation, sometimes it dies in the ground."[102]
- 2014 (May 26) A Viking gas pipeline explosion near Warren, Minnesota was "hell on earth," shaking the ground and shooting a fireball over 100 feet in the air. Roads within a two-mile radius were blocked off. Authorities suspected natural causes because there was still frost in the ground and the soil was wet.[98][103]
- 2017 (November 16) TransCanada's Keystone Pipeline leaked 210,000 gallons (5,000 barrels) of crude oil in Marshall County in northeastern South Dakota. Officials don't believe the leak affected any surface water bodies or threatened any drinking water systems.[104]
- 2018 (September 13) Suspected over-pressurization of natural gas pipes by Columbia Gas caused multiple explosions and fires in 3 towns in Massachusetts (Andover, Lawrence, and North Andover), leaving 1 dead.[105]

See also

- List of oil spills
- Natural gas pipeline system in United States
  - Pigging
- Hydrostatic test
- Varanus Island, Western Australia
  - 2008 Western Australian gas crisis
- Palaceknowe Gas Pipeline Failure, Moffat, Beattock[106]

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NTSB MOST WANTED LIST

CRITICAL CHANGES NEEDED TO REDUCE TRANSPORTATION ACCIDENTS AND SAVE LIVES

2014

ENHANCE PIPELINE SAFETY

What is the Problem?

On December 11, 2012, a buried 20-inch diameter natural ga tran mi ion pipeline ruptured near Inter tate 77 in Si onville, We t Virginia. The rupture cau ed a 20-foot ection of pipe to eparate, landing more than 40 feet from it original location. Although there were no fatalitie or injurie , three home were de troyed by the ignition of the gas and ensuing fire. This most recent in a series of cata trophic pipeline rupture and explo ion inve tigated by the NTSB ha brought increa ed attention to the 2.5 million mile of pipeline that traver e the nation. Pipeline remain one of the afe t and most efficient means of transporting vital commodities used to power home and upply bu ine e , but the con equence can be tragic when afe operational practice are not employed and tandard are not implemented.

High pre ure natural ga pipeline failure frequently re ult in explo ive releases that, if ignited, become intense "jetfires" that can cause exten ive damage. In addition to large- cale environmental damage, hazardou liquid pipeline accident al o po e a ri k of ignition, which occurred in June 1999, when a ga oline pipeline ruptured and ignited in Bellingham, Washington, killing three. As the nation's demand for oil and ga grow and the pipeline infra tructure age , we cannot afford to overlook the tran portation mode that lie buried beneath u .

What can be done?

Safe operation of natural ga and hazardou liquid tran mi ion pipeline i a hared re pon ibility among the operator, government over ight agencie , and local communitie . It begin with companie trengthening their operating practice to addre afety concern in de ign, in tallation, operation, maintenance, and in pection. Improving in-line in pection technologie and expanding the u e of pipeline in pection tool improve the chance of locating defect early and reduce the probability of a cata trophic failure. Companie hould al o incorporate hydro tatic pre ure te ting, which i u ed to demonstrate that existing flaws in the steel pipe will not grow and cau e a leak or failure under normal pipeline operating limit .

Aerial photo of the damage from the December 11, 2012, pipeline rupture that occurred we t of I-77 near Si onville, We t Virginia.

Over ight agencie al o play a role, e pecially when operator are reluctant to initiate afety improvement . Regulator can mandate specific safety program improvements to ensure pipeline operators adopt and improve practice that reduce the ri k and con equence of pipeline failures. For example, given the gas industry's reluctance to expand the u e of automatic hutoff valve and remote controlled valve , the Pipeline and Hazardou Material Safety Admini tration (PHMSA) hould require thi technology, which can i olate a rupture within minute and reduce the volume of ga relea ed and the duration of a fire.

Additionally, afety can be enhanced through improved communication between pipeline operator and the communitie through which their pipeline travel. Improving communication with emergency re pon e per onnel i particularly important. Pipeline operator hould provide accurate route map to emergency re ponder and trengthen their internal procedure for notifying the local emergency re pon e per onnel when leak or rupture are u pected. Early recognition that a pipeline relea e ha occurred coupled with accurate location information and notification to the local emergency responders can help reduce the con equence from an accident.

ENHANCE PIPELINE SAFETY

https://www.ntsb.gov/safety/mwl/Documents/2014/05_MWL_PipeSafety.pdf

What is the NTSB doing?

Archived 03 31 19 by Gene A. Nelson, Ph.D.

The NTSB ha inve tigated everal pipeline accident in which live were lo t and communitie everely affected. In 2007, in Carmichael, Mi i ippi, a propane tran mi ion pipeline ruptured, and the ensuing cloud of released gas ignited and created a fireball; two people were killed, even were injured and four home were de troyed. In 2010, in Mar hall, Michigan, a crude oil tran mi ion pipeline ruptured and relea ed oil for over 17 hour before being di covered. A a re ult, nearly 850,000 gallon of crude oil pilled into the urrounding area and flowed into local waterways, resulting in the most expensive environmental response and clean-up for an on hore oil pill in US hi tory. Ju t over a month after the Mar hall accident, a natural ga tran mi ion pipeline in San Bruno, California, ruptured and ignited in a re idential neighborhood; eight people were killed, and 34 homes destroyed.

Through the e inve tigation , the NTSB ha i ued a body of afety recommendation to addre recurring problem :

(1) operational practices;

(2) oversight deficiencies; and

(3) effective communication with emergency responders and local communities.

In addition to accident inve tigation , in 2005, the NTSB completed a tudy of Supervi ory Control and Data Acqui ition (SCADA) y tem that are u ed by pipeline operator to manage and operate their pipeline . The e y tem collect critical near real-time information about the entire pipeline operation and tran mit thi information back to computer con ole within a control center. SCADA y tem allow pipeline controller to monitor and detect anomalie in the y tem and to make change to the operation, uch a opening and clo ing valve or starting and stopping pumps, from a single remote location. The 2005 study uncovered five area for potential improvement: di play graphic , alarm management, controller training, controller fatigue, and leak detection systems. These findings in part led to a significant step forward for an indu try that did not previou ly have any rule governing hour of ervice. In December 2009, PHMSA published a final rule that required pipeline operators to establish shift lengths and schedule rotations that provide controllers off-duty time sufficient to achieve 8 hours of continuous sleep. Together, the NTSB's recent investigation of the Sissonville tran mi ion pipeline rupture, le on learned from previou inve tigation , and the SCADA tudy have prompted the NTSB to once again place pipeline afety on our Mo t Wanted Li t.

Critical changes needed to reduce transportation accidents and save lives

National Transportation Safety Board

The National Tran portation Safety Board i an independent Federal agency charged by Congre with inve tigating every civil aviation accident in the United State and significant accidents in other modes of transportation - railroad, highway, marine and pipeline. The NTSB determines the probable cau e of the accident and issues safety recommendations aimed at preventing future accident . In addition, the NTSB carrie out pecial tudie concerning tran portation afety and coordinate the re ource of the Federal Government and other organizations to provide assistance to victims and their family members impacted by major tran portation di a ter .

Diablo Canyon Independent Safety Committee

General Information About the Diablo Canyon Independent Safety Committee (DCISC)

http://www.dcisc.org/about/general-information.php

The DCISC publishes its Annual Report in November or December for the fiscal year ending June 30. In addition to summarizing its activities and review of Diablo Canyon operations, the Annual Report also documents the Members' conclusions and recommendations regarding Diablo Canyon operational safety.

PG&E provides a written response to each recommendation which is published with the Annual Report. The Committee then reviews PG&E's response and, if the DCISC is dissatisfied with PG&E's final response to any recommendation, the DCISC may raise the matter with the California Public Utility Commission (CPUC), with any or all of the Committee Members' appointing entities or with the Nuclear Regulatory Commission (NRC).) To date, PG&E has ultimately responded appropriately to each of the DCISC recommendations. The latest Annual Report is available on the DCISC website and all of the DCISC Annual Reports are available for review by any interested members of the public at the Reference Department at the R. E. Kennedy Library, located on the campus of California Polytechnic State University at San Luis Obispo.

In May of 1997, in response to the electric utility rate deregulation mandated by the California legislature, the CPUC issued a Decision which found that the DCISC remains a key element of monitoring the safe operation of Diablo Canyon. The Decision ordered that the DCISC remain in existence until further order of the CPUC.

DCISC Operation: Public Meetings & Fact-findings

The DCISC typically conducts three public meetings each year in the San Luis Obispo area. Dates, times and locations for these meetings are posted on the Committee's website, advertised in local newspapers and notices are sent to other news media and those persons who have requested advanced notice of the public meetings. All meetings include an opportunity for the public to address comments and provide information to the Committee Members. PG&E representatives are present to make informational presentations to the Committee on topics requested by the Members. Certain public meetings may include a tour of the plant with the Committee which is open to a limited number of members of the public on a first come first served basis, governmental representatives and members of the media. The meeting agenda and supporting documents, as well as a transcript of discussion at the public meetings, are on file and available to members of the public at the Reference Department at the R. E. Kennedy Library.

The DCISC conducts numerous fact-finding visits by individual Committee Members and consultants to the plant site and to other locations as necessary to assess issues, review plant programs and activities, interview and meet with PG&E management and employees, follow-up on current items on the DCISC's Open Items List and to identify agenda items for future public meetings. These fact-finding visits generally occupy one or two intensive days of research and investigation concerning PG&E's current activities and programs. Committee representatives also frequently observe meetings of PG&E's internal safety review organizations and

committees. A detailed written report, summarizing their activities, is prepared for each Fact-finding visit by the participants. Comments concerning these reports are sought from each of the other Members and consultants and, when approved by the Committee at a public meeting, the fact-finding reports are provided to PG&E. Fact-finding Reports are included as a part of the Committee's Annual Report and represent a valuable and useful tool for the Members, consultants and PG&E. The Committee's fact-finding visits constitute a vital and important aspect of the Committee's safety review function.

Public Comment and Communication

The DCISC provides extensive publicly available information concerning Diablo Canyon. Transcripts and minutes of each public meeting and reports of each fact-finding meeting and an extensive annual report on the safety of Diablo Canyon's operations are available by contacting the committee or at the R. E. Kennedy Library.

The DCISC welcomes comment and communication from members of the public and provides an opportunity for such dialogue during every session of its public meetings. The DCISC administrative office also maintains a toll-free 800 telephone line and an E-mail address to respond to questions or requests for information from members of the public.

Written comments or questions may also be directed to DCISC Members by contacting the office of the DCISCLegal Counsel

http://www.dcisc.org/about/history.php

The History of the Diablo Canyon Independent Safety Committee, DCISC

The Diablo Canyon Independent Safety Committee (DCISC) was established as a part of a settlement agreement entered into in June 1988 between the Division of Ratepayer Advocates of the California Public Utilities Commission (PUC), the Attorney General for the State of California, and Pacific Gas and Electric Company (PG&E) concerning the operation of the two units of PG&E's Diablo Canyon Nuclear Power Plant (Diablo Canyon). The agreement provided that:

"An Independent Safety Committee shall be established consisting of three members, one each appointed by the Governor of the State of California, the Attorney General and the Chairperson of the California Energy Commission, respectively, serving staggered three-year terms. The Committee shall review Diablo Canyon operations for the purpose of assessing the safety of operations and suggesting any recommendations for safe operations. Neither the Committee nor its members shall have any responsibility or authority for plant operations, and they shall have no authority to direct PG&E personnel. The Committee shall conform in all respects to applicable federal laws, regulations and the Nuclear Regulatory Commission (NRC) policies."

The agreement further provided that:

The DCISC shall have the right to receive certain operating reports and records of Diablo Canyon

The DCISC shall have the right to conduct an annual examination of the Diablo Canyon site and such other supplementary visits to the plant site as it may deem appropriate

The DCISC is to prepare an annual report, and such interim reports as may be appropriate, which shall include any recommendations of the Committee.

"THE LONG TERM FOCUS OF WISCONSIN'S CITIZEN UTILITY BOARD (CUB) HAS BEEN INDEPENDENT REPRESENTATION OF CONSUMERS INTERESTS."

https://cubwi.org/about-us/

History of Citizen Utility Boards in the United States

Citizens Utility Boards were created around the country to fulfill a vision of consumer advocate Ralph Nader. The goal was to provide a check on monopoly utility companies whose growth is dependent on large capital projects that raise costs for their own customers.

The Citizens Utility Board concept was floated as a way to empower customers by organizing them into democratically governed advocacy groups. CUBs gain a voice in regulatory proceedings by allowing them to tap the kind of expertise that utilities and organizations representing big businesses typically could afford.

Wisconsin CUB History

Wisconsin's CUB is the oldest operating Citizen Utility Board in the United States , it was created by the state Legislature in 1979 and opened in 1980.

In 1986, CUB reorganized as a private nonprofit organization in response to a U.S. Supreme Court ruling that prevented CUB from inserting membership brochures in utility bills. This ruling was a setback for CUB, hindering its ability to increase membership and raise funds to advocate on behalf of customers.

Over the years, CUB has expanded its reach beyond homeowners and renters; ***it now advocates for all kinds of small customers, from individual citizens to small businesses who can't afford to hire their own experts to argue for fair, safe and reliable utility service.***

In its early years, CUB focused on big telephone and telecommunications companies but the deregulation of the telecommunications market led CUB to narrow its focus to electric and natural gas utilities. More recently, the organization has moved to broaden its focus to include representation for customers of water utilities.

Across the U.S. states that have citizen utility boards, customers have saved billions and billions of dollars thanks to the advocacy of the various CUB organizations. Wisconsin is no different. At a time when Wisconsin utility bills have been rising, CUB's existence and expertise has helped keep those bills from being much higher: ***Since 2008, Wisconsin utility customers have saved $3 billion through Public Service Commission decisions that sided with CUB and its experts.***

MISSION/VISION

CUB IS A MEMBER-SUPPORTED, NONPROFIT ORGANIZATION WHOSE PURPOSE IS TO:

- Provide public interest legal services to ensure effective and democratic representation of residential and small business utility customers before regulatory agencies, the legislature, and the courts;
- Advocate for reliable, affordable and sound utility service; and
- Educate consumers on matters relating to utility regulation and energy policy.

Become a member. Donate today.

DONATE NOW

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https://cubwi.org/20170306-pressrelease-cub_news/

March 6, 2017: Citizens Utility Board Hires New Executive Director

For Immediate Release: March 6, 2017
More Information: **Tom Content, 608-251-3322 x. 12, 414-550-4712 (cell)**

CUB: Citizens Utility Board Hires New Executive Director

MADISON — Citizens Utility Board of Wisconsin (CUB) is pleased to announce that it has hired Tom Content as its new Executive Director, effective March 13, 2017. Mr. Content comes to CUB from the ***Milwaukee Journal Sentinel*** newspaper, where he has worked since 2000 and covered energy and utility issues since 2003. He also reported on utility issues for the ***Green Bay Press-Gazette*** in the late 1990s.

"Tom's deep and broad knowledge of the utility industry in Wisconsin, and his ability to communicate that knowledge clearly to diverse audiences, is reflected in the work he has done as a reporter," said Russell Wallace, President of CUB's Board of Directors. "CUB is Wisconsin's only full-time, professional advocate for residential, farm, and small business utility ratepayers. We feel fortunate to have hired someone of Tom's caliber to this important position, and we feel confident he is the right person to help us build CUB into an even more effective advocate for Wisconsin's utility ratepayers."

While Wisconsin is forecast to have more than adequate capacity and energy to meet demand over the next several years, it also currently has among the highest residential, commercial, and industrial electric power rates in the Midwest.

"Affordable utility rates are important to Wisconsin's families and seniors and are a vital component to a strong economy and to job creation in our state. As a state we need to do more, and we can do better on that front," Content said. "I look forward to working with the Commissioners and staff of the Public Service Commission, members of the Legislature, utilities, and other stakeholders. I'm especially eager to begin communicating with CUB's members and other ratepayers throughout the state, as we work to achieve the lowest rates possible consistent with sound business principles."

Creating a Carbon-Free Continuum

March 28, 2019 M. Herschel Specter Prepublication copy of ***OurEner Policy.Org*** article

Politicians have announced energy mandates, such as having 50% or 100% renewable electricity by 2030–2040. However, per the US EPA, electric power generation accounts for only 28% of the greenhouse gases (GHG) emissions, with **72% of GHG emissions** coming from **other energy used in the transportation, residential, commercial, industrial, and agricultural sectors**. **Even if there were 100% renewable electricity, the preponderance of the GHG emissions still comes from these other end use sectors. We need a carbon-free continuum—from the sources of energy, through their distribution systems, to all the end use devices that burn fossil fuels. Far more electricity would be needed to power electrified transportation, replace gas/oil space heaters and hot water appliances, and provide hydrogen for industrial applications. Even if all electricity were carbon-free, we would not reduce GHG emissions releases quickly enough, unless we simultaneously constructed this carbon-free continuum.**

There are hundreds of millions—perhaps a billion—end use devices that burn fossil fuels in the U.S. To create a carbon-free continuum, we need end use devices that are electrified and therefore, compatible with carbon-free electricity. This huge door-to-door replacement process with electrified end use appliances is expensive, time consuming, and likely to set the pace of reducing GHG emissions, yet few are talking about it.

The first step should be to support H.R.763, which promotes a carbon fee and dividend process. **Its passage into law would promote all sources of carbon-free electricity and energy conservation.** H.R.763 won't solve the huge logistical challenge described above, but it is an essential beginning.

A second step is for environmental groups to recognize that nuclear power is essential when dealing with climate change. The Union of Concerned Scientists now supports preventing the closure of existing nuclear power plants. Nuclear power is far more benign http://tinyurl.com/Become-A-Nuclear-Safety-Expert **that generally perceived. Severe nuclear accidents are rare and extremely unlikely to cause any near-term, off-site radiation fatalities or radiation sicknesses. Long-term radiation health effects, if any, would be too small to detect. The new calculus is that the risks from existing nuclear power plants are considerably smaller than risks from climate change.**

Legislators needs to think seriously about decarbonizing end use sectors and constructing a carbon-free continuum.

1. What other policies could be put in place to help focus on decarbonizing the end use sectors?
2. How important is it to include nuclear in a carbon-free future as opposed to a 100% renewables policy?

http://tinyurl.com/Become-A-Nuclear-Safety-Expert

Become a Nuclear Safety Expert

Rev. 2

HERSCHEL SPECTER

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January, 2019

ABOUT THE AUTHOR

Herschel Specter, President of Micro-Utilities, Inc., holds a BS in Applied Mathematics from the Polytechnic Institute of Brooklyn and a MS from MIT in Nuclear Engineering. He is a Licensed Professional Engineer in the State of New York. He has had a long association with the Indian Point nuclear power plants starting as a member of the Atomic Energy Commission (now the Nuclear Regulatory Commission) where he was the Licensing Project Manager for the original licensing of the Indian Point 3 nuclear plant in the 1970s. In the 1980s the New York Power Authority hired Mr.Specter to manage the defense of Indian Point 3 in a federal adjudicatory trial in the wake of the Three Mile Island nuclear accident in Pennsylvania. Prior to joining NYPA, Mr. Specter served at diplomat rank for 5 years at the International Atomic Energy Agency in Vienna, Austria where he headed up an international effort writing design safety standards for nuclear power plants.

Mr. Specter has been Chairman of two national committees on emergency planning and was a guest lecturer for several years on emergency planning at Harvard's School of Public Health. He led an effort as a consultant to Entergy analyzing emergency responses during a hypothetical terrorist attack on Indian Point. Mr. Specter has presented testimony at the National Academy of Sciences on the Fukushima accident and on other nuclear safety matters and has been a guest speaker at many universities on matters of energy policy. Today he is one of 14 Topic Directors in Our Energy Policy Foundation, a group of about 1500 energy professionals who seek to bring unbiased and comprehensive energy information to our political leaders and members of the public.

Mr. Specter was born in White Plains, NY and lives there now.

TABLE OF CONTENTS

1.0 Executive Summary

You too can become a nuclear safety expert and it should take you less than an hour. Becoming a nuclear safety expert does not require an advanced college degree. Further, you may learn aspects of nuclear safety that many, even some in the nuclear energy field, are unaware of. All you need to do is read the first three pages of this report.

Large quantities of carbon-free electricity will be necessary if we are to have a low carbon future, and nuclear power plants reliably do this. However, many people fear nuclear power plants and radiation in general. Therefore it is important for the public and governmental leaders to understand that the radiological and economic risks to the public from nuclear power plants are extremely small and certainly far smaller than many think. There are multiple reasons for this, but one that has not received sufficient attention is the protective role of natural forces. In addition to man-made engineered safety systems, natural forces like gravity, changing wind direction, human biology, weathering, and several others, greatly reduce the consequences of nuclear accidents. These natural forces do not need electric power or actions by plant operators or emergency workers to reduce radiological consequences. These natural forces are always there and no act of terrorism or anything else can prevent them from protecting the public. Because of these man-made and natural protective features, the benefits of using nuclear power to reduce the challenges of climate change greatly outweigh its risks.

Two other areas that are poorly understood are the significant safety importance of the containment buildings and the simplicity and high effectiveness of a modern emergency plan. In order to clarify the safety benefits of natural forces, containment buildings, and a modern emergency plan, this report examines four major nuclear accidents and two advanced accident analyses by Sandia National Laboratories to highlight the roles that these features play in protecting the public and off-site property.

Insights from Sandia's advanced computer analyses reveal that nuclear accidents release far less radioactive material into the environment than thought before, that these more limited releases enter the environment much later than thought before, and that these releases are much more gradual. These three characteristics are all beneficial in protecting the public. A review of the Fukushima accident in Japan, provided in this report, supports all three of these Sandia insights.

The bottom line of all this is: In US designs, and those of many other countries, severe nuclear power plant accidents are rare and extremely unlikely to cause any near term off-site radiation fatalities or radiation sicknesses. Long term effects, **if any,** would be too small to be detected. We also know today that the risk of contaminating land areas from a nuclear accident is far less than thought before because only very small amounts of cesium would be released and because natural "weathering" effects rapidly reduce cesium dose rates. Extreme claims about nuclear accident consequences are not supported by advanced analyses or by actual nuclear accidents.

Nuclear power plants operating today do not represent a significant threat to society. Future nuclear plant designs will do even better as many new designs will avoid reactor meltdowns altogether. Carbon-free electricity from nuclear power plants is essential in dealing with climate change.

2.0 Key Points

A. Nuclear accidents that could release radioactive material into the environment are very rare, about one chance in a one hundred thousand per year to one chance in a million per year per nuclear power unit.

B. Nuclear power plants are designed to have, and to operate within, well defined safe operating envelopes.

C. If something goes awry there will be no reactor core damage if the reactor fuel is adequately cooled. There are multiple safety systems designed to cool the reactor fuel. Fuel heat rates drop quickly once the reactor is shut down, which would happen immediately.

D. If the reactor fuel can not be adequately cooled because there has been a total loss of off-site and on-site electric power, i.e., a station blackout situation, the passive containment building would still provide extensive public protection. For pressurized water reactors (PWRs) like Indian Point and Diablo Canyon, at least 24 hours would be available in a station blackout situation before significant containment leakage would begin. During this time period natural forces like gravity, plating out on metal surfaces, and being trapped in wet surfaces and in pools of water generated by the accident, would greatly reduce airborne radioactive material within the containment building well before significant containment leakage would occur, leaving little to be released to the environment.

E. Even without an emergency response, the limited released radioactive material would be unlikely to cause off-site near term fatalities or detectable long term radiological fatalities. Off-site economic losses and contaminated areas would be **far less than thought before.**

F. Nonetheless, nuclear safety philosophy requires a *defense-in-depth* approach. As such, an off-site emergency response would be put into action if there were an impending release of radioactive material. Guidance from the Environmental Protection Agency calls for emergency plans to balance radiological and non-radiological risks. A modern emergency plan would minimize both radiological and non-radiological consequences. This would be accomplished by a combination of in-close evacuation (innermost two miles from the site) prior to the release of radioactive material, then downwind sheltering after the release began, and even later, relocations if there were hot spots, including any hot spots that were beyond the ten mile Emergency Planning Zone (EPZ). Modern emergency plans would be far simpler and much safer than massive evacuations.

G. In a nuclear accident, the range of the radiation-caused near term (early) fatality risk is between **zero to one mile** from the point of release and the range of radiation sicknesses is between **zero to two miles.** By evacuating the innermost two miles prior to the release of radioactive material all near term radiation effects from an accident are expected to be eliminated. There is ample time to achieve this focused evacuation and it involves less than 4% of the EPZ area. Downwind sheltering reduces long term radiation effects, if any, and minimizes the non-radiological risks of over-evacuation. While a total evacuation of the whole EPZ would eliminate near term radiation consequences, it would add to the non-radiological risks. Thus a total evacuation of the whole EPZ is not an optimum response. Extreme evacuations out to 50 miles, as some have suggested as necessary, are dangerous, have no basis in science, and must be avoided.

H. See TABLE A-1 for a compilation of consequences from four actual nuclear accidents.

TABLE A-1 Radiological Consequences from Four Nuclear Accidents

Power Plant	Number of **on-site** near term fatalities	Number of **off-site** near term fatalities	Long term fatalities	Comments
Browns Ferry	0	0	0	Reactor fuel never damaged, no releases to the public.
Three Mile Island	0	0	0	Reactor meltdown, no significant leakage from the containment building.
Fukushima	0	0	Would be too small to be detected, even when conservatively calculated.	3 Reactor meltdowns, containment leakage after 12 hours. Containment building and emergency diesels survive magnitude 9 earthquake. Tsunami causes station blackout. Only small releases of iodine and cesium, consistent with modern accident analyses.
Chernobyl	28	0	No observed cases of leukemia, even after 30 years. Thyroid cancers among children in Belarus, Russia, and the Ukraine.	Rapid power excursion, burning graphite, no containment building -only a very limited confinement building. Contamination of nearby land and property, some of which still kept off-limits. However, dose rates from widespread release of cesium have decreased rather rapidly from “weathering” effects. Thyroid cases caused by drinking contaminated milk, 99+% successfully treated. This consequence would not happen in the US or elsewhere (e.g. Japan) because of contaminated food interdiction programs.

3.0 Insights From Four Actual Nuclear Accidents and Advanced Accident Studies

3.1 Introduction

This section starts out with normal operating conditions and then reviews four actual nuclear power plant accidents that range from no damage to the plant to extensive damage with large releases of radioactive material into the environment. These actual accident analyses are supplemented with insights gained from advanced accident analyses performed by Sandia National Laboratories. It will be shown that the accident at Fukushima, Japan is supportive of the general conclusions reached by Sandia National Laboratories analyses. The Fukushima accident also provided insights on how to develop a modern emergency plan. The importance of natural forces, the containment building, and the benefits of a modern emergency plan are woven into the discussions below.

3.2 Nuclear Accidents are Rare

Everyone has an interest in having a low likelihood of a severe accident at any nuclear power plant. Nuclear regulators, in their role of protecting the public, want to keep the chances of having a release of radioactive material into the surrounding environment to a very small number. Utilities that own/operate nuclear plants share this concern for public safety and also seek to avoid the very large economic penalty of losing a major asset, the considerable cost of cleaning up a damaged power plant, and off-site costs. The design of nuclear plants includes a variety of instruments, such as temperature, pressure, flow rate, and water level gages, that continuously measure the status of the power plant to keep the plant in its well defined operating envelope. Should something go awry, all kinds of engineered safety equipment - pumps, valves, emergency electric diesels, batteries, sprays and the like - are rapidly activated to prevent damage to the reactor and the containment building while returning the plant to a safe condition. In addition to automatic safety equipment at a nuclear plant, there are operators who have been trained to return the plant to a safe condition if a nuclear power plant strays outside of its well defined operating envelope. As a result of these operator actions and engineered safety features, the chances of having a core melt situation is between one chance in 10,000 to one chance in 100,000 per year per nuclear power plant. Core melt sequences do not necessarily lead to a release of radioactive material into the environment. The frequency of releases of radioactive material into the environment is in the range of one chance in 100,000 to one chance in 1,000,000 per year per nuclear power plant, or smaller.

3.3 The Containment Buildings

US nuclear containment buildings are very robust structures. They have withstood category 5 hurricanes, tornadoes, external flooding, and earthquakes. A measure of the great strength of US containment designs occurred in Japan in March, 2011 when a magnitude 9 earthquake struck. All the containment structures in Japan’s 50+ nuclear power plants withstood this extreme seismic event.The damage done to the Fukushima plant was due to the tsunami that followed the seismic shock. Not only can these containments withstand very large external forces, they have considerable margins to withstand high internal pressures. For example, nuclear power plants with large dry containment buildings can withstand internal pressures up to about 220% of their design pres-

sure before significant leakage would begin. For station blackout accident scenarios, it would take between 25 to 45 hours before such leakage would begin with this type of containment building.

3.4 The Browns Ferry Accident

A fully mitigated nuclear accident with an intact containment

In 1975 there was a serious fire at Unit 1 of the Browns Ferry Nuclear Plant in Alabama. All during this fire adequate cooling of the reactor fuel was maintained and therefore there was no fuel damage or any leakage from the containment. Because there was no fuel damage, there was no release of radioactive material into the environment. Therefore this was a fully mitigated accident. Even though there was no fuel damage and the public was never in danger, lessons were learned which led to fire protection upgrades.

3.5 The Three Mile Island Accident

A partially mitigated nuclear accident with an intact containment

In 1979 the accident that occurred at the Three Mile Island in Pennsylvania was caused by a series of operator errors and a stuck open relief valve that led to large amounts of reactor cooling water being dumped into the containment building. This, and a lack of adequate core cooling because of other operator errors, led to damage of the reactor fuel and a melt down. This was a partially mitigated accident because the containment building was never overpressurized and only miniscule amounts of radioactive material entered the environment. Again, although the public was never in danger, this accident was extensively reviewed and additional safety upgrades, along with additional operator severe accident training and procedures, were implemented.

3.6 The SOARCA Analysis

Two hypothetical accidents with no mitigation, followed by leakage from the containment building.

The source term is the amounts and types of radioactive material in the nuclear reactor core that calculated to be released into the environment from a nuclear accident. The smaller the amount, the smaller the off-site effects. An early estimate of a severe accident source term (called the SST1 source term) was presented in 1982 by Sandia National Laboratories. Many years later, in 2012, Sandia National Laboratories published[1] NUREG-1935 “State -of-the-Art Reactor Consequence Analyses (SOARCA) Report” which reflected great advances in accident analysis technology since its 1982 report.

TABLE A-2 compares the 1982 Sandia SST-1 source term to the SOARCA results for a Pressurized Water Reactor (PWR) with a large dry containment building, like the Indian Point, Diablo Canyon power plants and others. The SOARCA analyses presented here[2] examined two different station blackout scenarios, one short term and one long term. These hypothetical station blackout

[1] A companion document is NUREG-7110, Volume 2.

[2] See NUREG-1935, TABLE 7-1.

scenarios assumed that all engineered safety features were inoperable. The differences in source terms between the 1982 report and these SOARCA analyses are profound, with the modern calculated source terms much smaller than the 1982 estimates. TABLE A-2 also shows that the calculated times for releases to begin to enter the environment of 25.5 to 45.3 hours, are far longer than the 1982 number of 1.5 hours. These much longer time delays provide (1) many more hours for natural forces to reduce airborne radioactive material in the containment air space, (2) ample time to evacuate the innermost two miles near the reactor site prior to the release of radioactive material, and (3) more time for plant operators to end the core melt sequence before releases to the environment begin.

TABLE 7-1 of NUREG-1935 also compared the SST-1 and SOARCA release fractions of other fission products, but they were not included in TABLE A-2 because they are comparatively unimportant for calculating off-site health and economic consequences[3]. Radioactive iodine-131 and to a lesser extent radioactive tellurium, dominate early health effects. Cesium-137 dominates long term health effects and land contamination issues. Reactor cores have initial inventories of radioactive fission products. A release fraction is that portion of an initial radioactive inventory that enters the environment.

TABLE A-2 SST-1 and SOARCA Release Fractions

	Core damage frequency, events/yr	Tellurium release fraction	Iodine release fraction	Cesium release fraction	Release start, hours	Release end, hours
SOARCA in 2012, Short term station blackout in a large dry PWR	$2x10^{-6}$	0.006	0.006	0.001	25.5	48.0
SOARCA in 2012, Long term station blackout in a large dry PWR	$2x10^{-5}$	0.006	0.003	0.000	45.3	72.0
SSTI in 1982	$1x10^{-5}$	0.640	0.450	0.670	1.5	3.5

3.6.1 What are the Major Insights from SOARCA?

There are three dominant differences between the 1982 SST-1 source term and the 2012 SOARCA source terms:

1. The amounts of radioactive material calculated to be released to the environment are much smaller in the SOARCA analysis than the 1982 SST-1 source term,

[3] NUREG-1935 TABLE 7-1 also included release fractions for Xe, Ba, Ru, Mo, Ce, and La.

2. The time that these releases begin to enter the environment is much later in the SOARCA analysis,
3. The duration of these releases is much longer in the SOARCA analysis.

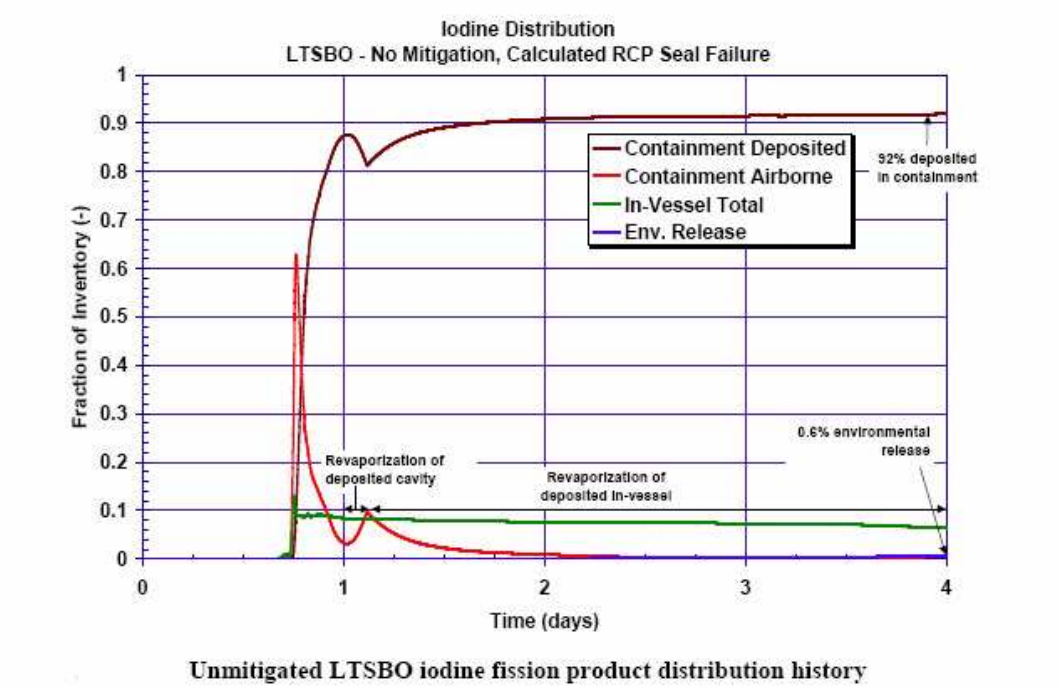
All three of these insights are supported by the analyses shown in TABLE A-2 and by an analysis of the Fukushima accident. All three of these differences reduce calculated off-site radiological health effects, as discussed in Section 4 of this report.

3.6.2 Why are the SOARCA Calculated Release Fractions so Small?

Even though the SOARCA analyses assumed that no engineered safety systems were operable because of a total station blackout and that leakage from the containment began after 25.5 to 45.3 hours, the calculated releases of iodine and cesium, and others, were very small. This is because natural forces like gravity, plating out on metal surfaces, and being trapped in wet surfaces and within pools of water created by the accident greatly reduce airborne concentrations of radioactive material in the time period before containment leakage becomes significant.

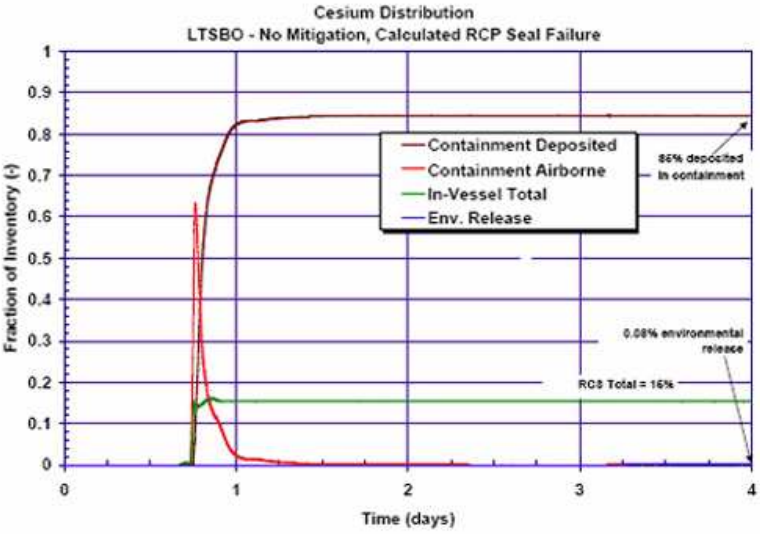
FIGURE A-1 which depicts the airborne iodine concentration as a function of time for a large dry PWR containment for a long term station blackout sequence where significant containment leakage does not begin until 45.3 hours after accident initiation. Note that the iodine concentration in the containment air space reaches high levels around the time of reactor vessel failure. However, these airborne iodine concentrations rapidly decrease after their peak because of the above natural removal processes. This rapid drop off in iodine airborne concentrations occurs before there is significant containment leakage. Airborne concentrations in the containment air space for cesium and other fission products have profiles similar to that of iodine. See FIGURE A-2.

FIGURE A-1 Iodine Distribution, Long Term Station Blackout (Sandia)



Unmitigated LTSBO iodine fission product distribution history

FIGURE A-2 Cesium Distribution, Long Term Station Blackout (Sandia)



Unmitigated LTSBO cesium fission product distribution history

3.7 The Fukushima Daiichi Accident

An unmitigated accident with significant containment leakage after 12 hours

On March 11, 2011 the Great East Japan Earthquake of magnitude 9 struck Japan. This earthquake was so powerful, portions of the seafloor were moved 17 feet. Tsunamis up to about 50 feet were generated and the human death toll from this extraordinary event took the lives of about 19,000 people. By way of contrast, there were no fatalities caused by radiation from the three simultaneous reactor meltdowns at Fukushima.

In spite of the great forces generated by this extraordinary earthquake, none of the containment buildings and none of the engineered safety features failed in any of Japan's 50+ reactor units. The earthquake did cause a widespread loss of the electric grid, immediately causing nuclear plants to turn to their emergency diesels for electric power. All operating nuclear plants automatically shut down when this huge seismic event struck.The three Fukushima Daiichi meltdowns were not caused by this powerful earthquake directly, but by the towering tsunami that followed that flooded out an electric panel that controlled the electric diesels and components used for water circulating functions. Until the arrival of this towering tsunami inundated the diesel generator control panel, the emergency diesels at Fukushima Daiichi operated as they were designed to do.

Once all electric power was lost at Fukushima the reactor fuel could not be cooled and core melt sequences were initiated. At that moment the containment buildings with their suppression pools stood as the final barriers between the public and the reactor melt downs. Much of the radioactive material was captured within the plants' suppression pools and elsewhere within the containments.

3.7.1 Fukushima and SOARCA comparisons

TABLE A-3 shows that the three general characteristics of nuclear accidents derived from the SOARCA analyses (See Section 3.5) are supported by observations from the accident at Fukushima.

TABLE A-3 SOARCA and Fukushima Comparisons

Fraction of Reactor Core Inventory	Iodine	Cesium
1982 SST-1 source term	0.450	0.670
Fukushima (average of three meltdowns)	0.017-0.083 Smaller than thought before	0.009-0.029 Smaller than thought before
N/A	Start of release after shutdown	Duration of release
1982 SST-1 source term	1.5 hours	Two hours
Fukushima	> 12 hours, longer than thought before	~13 days, more gradual than thought before

3.7.2 Fukushima Emergency Response History

TABLE A-4 provides a history of the evacuations and sheltering for the Fukushima accident.

TABLE A-4 Fukushima Evacuation and Sheltering History

Time in year 2011	Distance from site, km	Action
March11,@ 14:46	N/A	Magnitude 9 earthquake
March 11@ 15:42	N/A	Units 1,2, and 3 lose power
March11@ 20:50 and@ 21:23	2,3	Two pre-emptive evacuations
March 12@ 05:44	10	Compulsory evacuation
March 12@18:25	20	Compulsory evacuation
March 15	20-30	Shelter in home
March 25	20-30	Self evacuation
April 22	Areas with dose rate > 20 mSv/year	Evacuation within a month
June 16	Hot spots with dose rate > 20 mSv/year	Recommended for evacuation (relocation)

3.7.3 Evacuation Lessons Learned

The emergency response to the simultaneous three meltdowns at Fukushima was a radiological risk success, but a non-radiological risk failure. The World Health Organization (WHO) and the US National Academy of Sciences have concluded that there were no early fatalities due to exposure of radiation and that long term effects, even when conservatively calculated, would be too small to be detected.

Once the two pre-emptive evacuations were completed, the near term fatality and radiation sickness risks were eliminated. Unfortunately, additional ordered and voluntary evacuations out to 30 km took place. Over 100,000 people were evacuated, some very hastily before they could even take their medications with them. Many were placed in crowded shelters and the stresses of this, plus fears of having been irradiated plus stresses from the assumed loss of long held homes, farms, and family burial grounds resulted in non-radiological deaths. Over 1000 deaths are attributed to this over-evacuation response. Years after the accident some people in government shelters still refused to return to their homes even though these homes were safe, having once been told that they had to evacuate. Fear is a powerful force.

Had the emergency response to the Fukushima accident been one of downwind sheltering once the pre-emptive evacuation had been completed, many of these non-radiological deaths might have been avoided.

3.7.4 Other Lessons Learned

All nuclear accidents and operating events, even if they do not lead to core damage or releases of radioactive material into the environment, are carefully scrutinized to learn lessons from them. The Fukushima accident was no exception to such safety re-examinations. In the United States addition safety equipment and procedures have been added. These safety additions differ from past responses. The emphasis here was to give plant operators additional capability and flexibility to deal with unexpected conditions. A major goal was to prevent reactor fuel damage, even in a station blackout condition. Among the post-Fukushima safety enhancements was the placement of portable electricity generators at different locations within a nuclear power plant and additional means to deliver cooling water at different plant locations.

3.8 The Chernobyl Accident

<u>An unmitigated accident without any containment building protection</u>

The largest release of radioactive material into the environment from a nuclear accident occurred at Chernobyl in April, 1986 because of a flawed design and inappropriate actions taken by the plant operators that initiated this accident.

In US designs a loss of cooling water, perhaps through a pipe break, immediately shuts the reactor down because the chain reaction can not be sustained. No operator actions or insertion of control rods would be necessary, although this would happen automatically. However, the physics design the Chernobyl reactor was different from US designs and the loss of water had the opposite effect. The power level spiked 100 fold in just 4 seconds. The Chernobyl plant did not have a contain-

ment building. Instead, a confinement building with only a one psi pressure capability was used. A typical large dry containment building in the US has a design pressure around 45 psi but, because of a significant margin, can reach about 100 psi before extensive leakage would begin. There seems to be a hundred fold more pressure protection in US large dry containments compared to Chernobyl's confinement building.

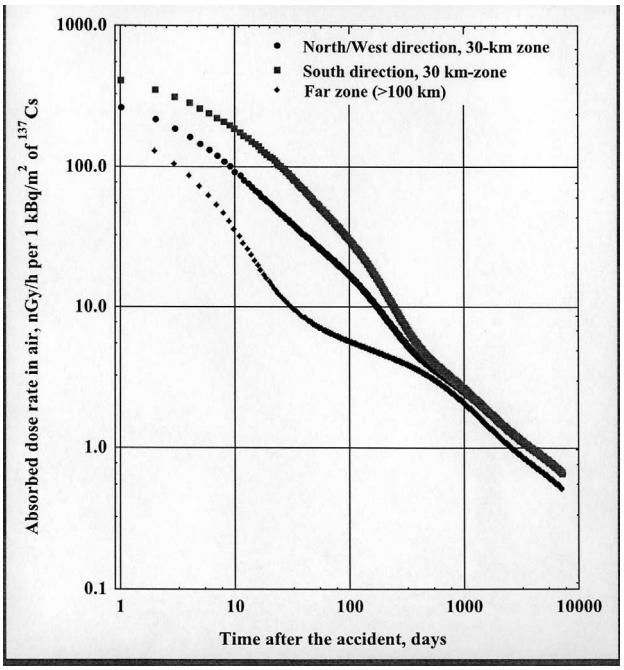
The Chernobyl design also had a large, very hot, block of graphite within its reactor vessel. Once outside oxygen came into contact with this graphite a fire ensued. So the Chernobyl accident released both energy from the nuclear power excursion plus chemical energy from the graphite fire. Since there was only a very limited confinement building, radioactive material from the accident entered the environment very rapidly. There was no time for various natural removal processes, described before, to reduce these releases.

The intense heat of this accident caused the radioactive plume to rise vertically from the damaged plant. This had two effects. First, three people who flew through this highly radioactive plume in a helicopter later died from this exposure. Second, radiation levels in the public areas surrounding the plant were actually quite low because of the vertical rise of the plume. **No member of the public at Chernobyl became a near term fatality.** There was a total of 28 deaths from Chernobyl, all of which were due to **on-site** exposure. Three of these 28 deaths were the people exposed in the helicopter and the rest were on-site emergency workers, like firemen putting out the blaze.

3.8.1 More Natural Forces

The Chernobyl accident released far more cesium-137 than would be possible with a design that met US specifications. Cesium-137 has a long half life, about 30 years. Because of the long half life of cesium-137, people have been concerned that areas where the radioactive plume deposited cesium-137 would be contaminated for very long periods of time. As it turns out, **natural forces** like rainfall, soil covering ground shine from cesium, etc., rapidly reduce dose rates from cesium-137. FIGURE A-3 presents above-ground, post Chernobyl, radiation level measurements. The decrease in dose rates over time is significantly more rapid than what would be expected if radioactive decay were the only mechanism for reducing doses. Since the dose rate from released cesium-137 decreased far more rapidly than thought before, projections of the size of contaminated areas and the long term health effects of people who reoccupy affected areas are far less than thought before. FIGURE A-3 was presented at the Beebe Symposium hosted by the National Academy of Sciences, held in recognition of 30 years after the Chernobyl accident.

FIGURE A-3 Decrease in Dose Rate from Cesium Released by Chernobyl Accident



4.0 Off-Site Near Term Health Consequences

It was previously stated that the range of the early fatality risk from nuclear power plant accidents is expected to be between zero and one mile. The range of radiation sickness is expected to be zero to two miles. Several natural forces combine to achieve this. First there is human biology which requires very high doses to cause a fatality. This is shown in FIGURE A-4[4], at below about 1.5 Grays (Gy), or 150 rads, of exposure there is essentially no chance of becoming a near term fatality, assuming minimal medical treatment. In other words, human biology establishes a radiation exposure threshold below which there is effectively no chance of causing an early fatality. An exposure of 150 rads may not be achievable with the kind of very small radioactive releases that SOARCA calculates. If there were supportive medical treatment, the threshold is higher where exposures below around 2 Grays (200 rads) should not lead to an early fatality. Additionally, the chances of causing a near term fatality are also dependent on the dose rate. At slower dose rates it would take a larger exposure to cause a near term fatality. The more gradual releases of radioactive material predicted by SOARCA and observed in the Fukushima accident should increase the threshold level somewhat.

There are multiple ways of reducing a person's dose in addition to evacuation and sheltering. Two natural process that would reduce doses are diffusion and wind direction changes. Diffusion is a natural process that is easily observable. Plumes thin out and widen as they move away from their points of release. This means that a person under a radioactive plume that is further away from the point of release would get a smaller dose, i.e., distance reduces the dose rate.

Because of the decreasing dose rate with distance, distance alone from a damaged nuclear power plant is sufficient to limit the range of the early health effects. Regardless of the size of the radioactive release, there is always some distance at which radiation exposures fall below the threshold of becoming a near term fatality. Reviews of different accident analyses and actual accidents place this limiting distance between zero and one mile for near term fatalities and zero and two miles for radiation sicknesses.

In addition to the dilution effects of distance, lower downwind doses would occur if there are wind shifts during the long duration of the release of a radioactive plume from a nuclear accident. If a wind shift ended up with the radioactive plume covering twice the area compared to the area covered by plume with a steady wind direction, exposed individuals would get only half the dose. FIGURE A-4 can be used to illustrate the importance of thresholds to wind shifts. Assume that a person experiencing a steady wind direction received a very high dose of 3 Grays. In this hypothetical situation, according to FIGURE A-4 with minimal medical treatment, there would be about a 50% chance that this very exposed individual would become an early fatality. Now take another hypothetical case where the wind has shifted so that two individuals each receive half the dose, 1.5 Grays, of the first individual who received 3.0 Grays. Figure A-4 indicates that these two individuals with half the dose each would be below the threshold for near term fatalities. In this hypothetical example the chances of causing a near term fatality from exposure to radiation decreased from 50% for one individual to 0% for two individuals. Even though the same amount

[4] Figure 3.1 of "Health Effects Models for Nuclear Power Plant Accident Consequence Analysis", NUREG/4214, Rev.2, Part 1, ITRI-14, October, 1993.

of radioactive material was released into the environment in these two hypothetical cases, wind shifts can significantly lower calculated early health risks from nuclear accidents.

Actual meteorological data taken at the Indian Point nuclear power plant provide more insights. At this site, on average, there is about a 50% chance that the wind will shift one sector (22.5 degrees) in just one hour. Every four hours, on average, there is a 50% chance the wind will shift the wind will shift three sectors (67.5 degrees). Considering the very long times now calculated for the gradual release of radioactive material (See TABLE A-2), changing wind directions make it less likely that anyone can acquire high doses. As a further layer of protection, a pre-emptive evacuation of the innermost two miles by itself should eliminate all near term radiation risks.

FIGURE A-4 Risk of Mortality Versus Radiation Exposure

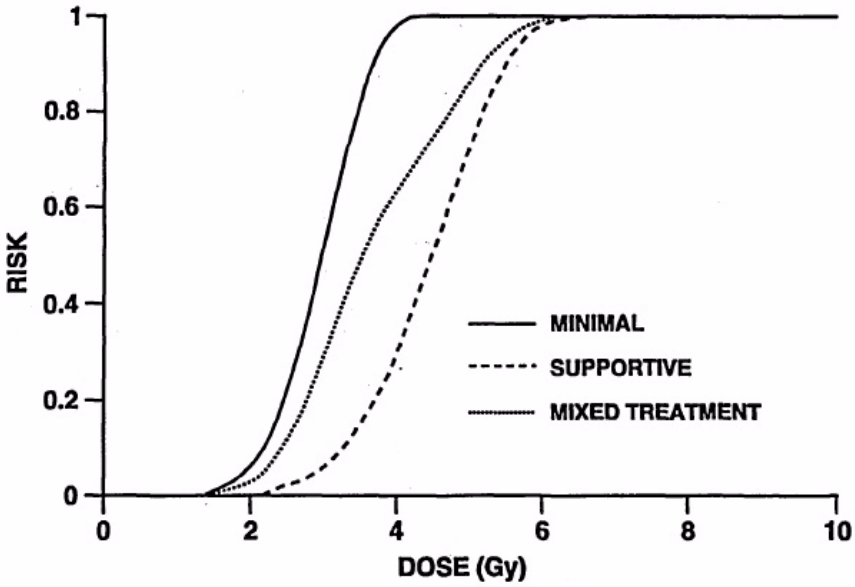


Figure 3.1 Risks of mortality from the hematopoietic syndrome for minimal, supportive, and mixed treatments: central estimates for exposure at a high dose rate.